SCIENTIFIC AMERICAN

A Weekly Review of Progress in

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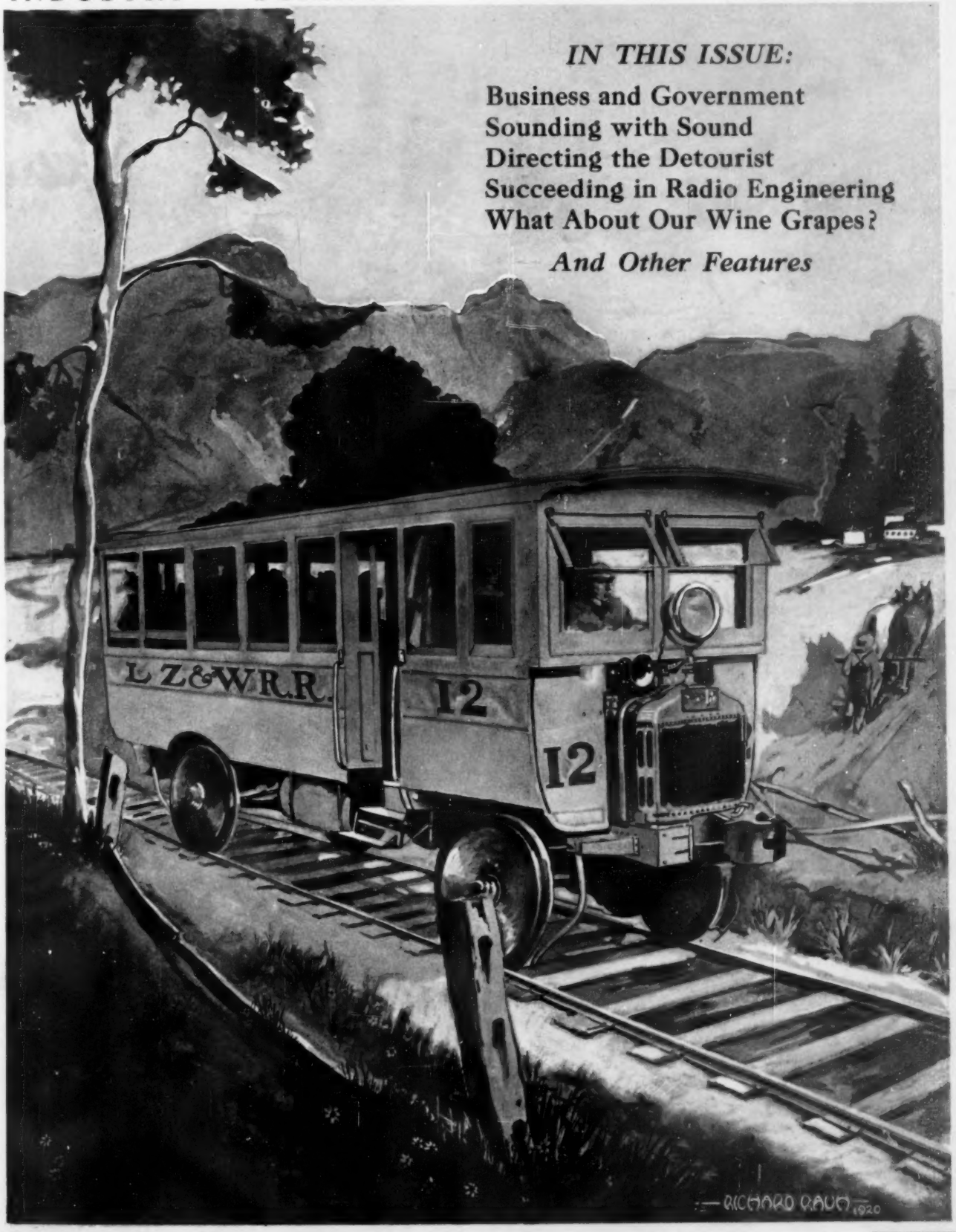

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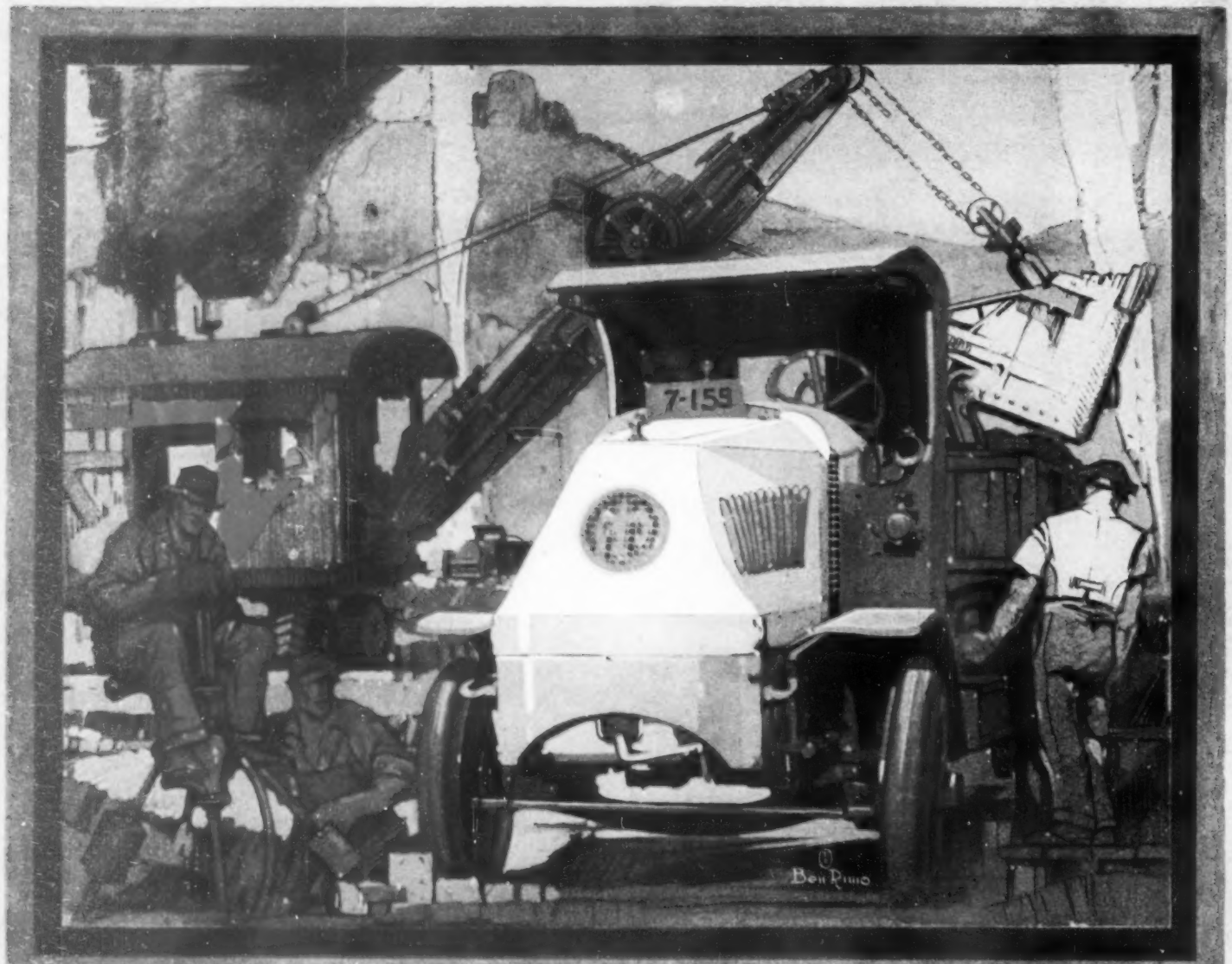

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SCIENTIFIC AMERICAN

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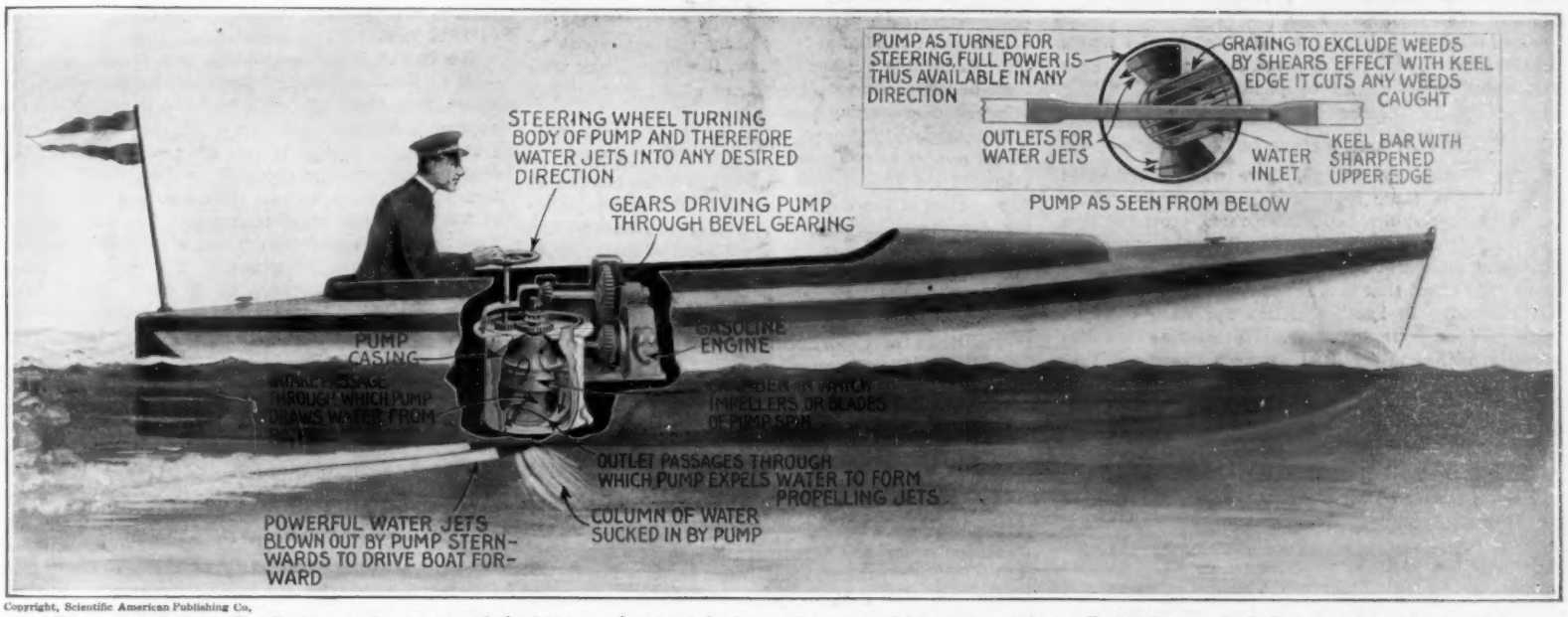

By means of two hydraulic jets, an intake provided with a weed-cutting device, and a motor-driven pump, this small craft is propelled along at a fair rate of speed

A Boat That Pumps Its Way Along

HISTORY is forever repeating itself in certain fields of applied science and invention. And, strangely enough, the public at large is not aware of the fact for the simple reason that said public has a very short memory indeed. Every so often a system or design or device is re-introduced at an exposition or trade show or even chronicled in the press, whereupon the great mass of the public acclaims the article, whatever it may be, as something entirely new, unthought-of in the past, and a revolutionizing factor of the future. Meanwhile a few of the better informed and learned folk merely shake their head at the naïveté of their brethren at large.

Coming down to specific cases, we have the boat that is driven along by a jet of water. Every so often such a means of marine propulsion is revived, and immediately it is acclaimed by press and public alike as the forerunner of a new era in maritime travel. A few short months hence and the scheme is forgotten, only to reappear several years thereafter. Only recently at the motor boat show held in London there was shown a water-jet propulsion scheme for small boats, which forms the basis of the above illustration. The new scheme—or at least the latest version of an old idea—employs neither propeller, airscrew nor paddle. Two hydraulic jets formed by a special pump push the boat along at a fair rate of speed. No rudder is necessary, the boat being steered by shifting the alignment of the water jets. The pump, which takes in water through intake passage and expels it through the propelling jets, is driven by a gasoline engine. The drawing is sufficiently self-explanatory to convey the idea.

It will be noted that such a scheme is, theoretically at least, suitable for navigation in shoal waters. In fact, where weeds are apt seriously to interfere with a propeller, this propulsion scheme is more or less necessary, since weeds cannot prevent it from functioning, according to the claims of the inventor, Major J. H. W. Gill. However, in all previous schemes of this kind it has been found that the jets do not deliver sufficient propulsion for marine purposes, and the same amount of horse-power expended can better be employed in driving a propeller in the conventional way. It may be, however, that the present version is more efficient than those which have gone before.

Fighting a Fisherman's Pest

ANOTHER attempt is being made to kill off the hair seals that live in such numbers on the flats at the mouth of the Fraser River. This great salmon stream has been the home of the seals since the memory of white men. The hair seal is a true seal with a black and white spotted coat of hair, but no underlying fur. He grows in size from a kitten as big as a spaniel puppy to an animal of perhaps 350 pounds in weight. His cousins of the Queen Charlotte and Vancouver Island reefs reach a ton in weight, but they do not get into the inland channels. The latter animals are known sometimes as sea lions.

The hair seals of the Fraser have been thorns in the flesh of the fishermen ever since salmon fishing became a recognized industry. They are strong, aggressive, and quite intelligent. They have learned that fish collect in the nets of the fishermen and on the baited lines. They rob nets and lines, break them to pieces, and thus cause loss not only of fish but also of fishing tackle.

Various campaigns have been undertaken to clean up the colonies of these animals, but without success. They are hard to trap, seldom are found within reach of a gun, and avoid flats where men are liable to be seen. Yet they are always on hand. A hair seal will follow a man who is trolling, for hours, and frequently plucks the salmon from the hook after one has been caught. If one is shot the body turns on its back, the air comes from the lungs, the creature sinks like a stone. At one time the government tried the benefits of a bounty, but it did not bring results desired. The leather is marketable, when obtained, but there are few pelts brought in.

The government has now decided to try an experiment. Cross lines, operated by two employes of the department of marine and fisheries, will be strung over the shallows of the river mouth, where seals are most frequent. This will be the third government effort. The first was the bounty, the second was a measure brought on perhaps by wartime conditions. Explosives had played such havoc to fighting humans in Europe that their efficiency with regard to seals was considered. Two years ago a mudflat on the Fraser, where the seals sunned themselves in hundreds, every day, was mined with high explosives, arranged to be exploded by pressure on a button. The mines were exploded. Hundreds of seals are said to have been killed, though few bodies were found. The experiment was expensive, and was not repeated, as no appreciable reduction in the hordes of amphibians was noted, and it was thought that the natural birth-rate of the creatures would more than offset the harvest of dead animals by the mine method.

This third attempt is one which promises results in reduction of seals, and in saving the skins for market. The method is practically the old and illegal night-line. A strong line is strung across the current with short lateral lines hanging deep in the water. At the lower ends of the shorter lines are strong, sharp, steel hooks. These catch the bodies of the seals as they swim through, and hold them until they drown or until the men come and dispatch them. If it proves successful an extensive campaign will be undertaken in an effort to rid the broad flats and waters of the Fraser of the animals.

New Hollow Brick Introduced in England

A NEW brick that has recently been introduced in England is nearly five times as large as an ordinary brick, but in comparison is much less heavy and is easily handled. The lighter weight results from the hollowing out of the brick to provide air layers. By the shaping of the ends the existence of joints running all the way through a wall is avoided.

The brick is, as a rule, made of 1 part of cement and 4 parts sand by simple hand machinery. Three men can make enough bricks in a day to build 400 to 500 square feet of wall. A further economy is effected by the manner of laying the walls, inasmuch as the ends and bottoms of the bricks need only to be dipped in a thin lime mortar mixed with a small amount of cement. If laid in the usual way the air channels in the bricks would become filled.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

"Until Human Nature Is Changed"

NOT many years ago, there was unearthed in Egypt some sculptured granite walls, whose hieroglyphics, being interpreted, proved to be a code of laws drawn up some five thousand years ago for the regulation of human affairs. One of these laws was to the effect that it was unlawful for a citizen to sell something to another citizen for more than he knew it to be honestly worth. We mention this illuminating historical fact, not so much to suggest that the profiteer was abroad in the land in those ancient days, as to draw attention to the everlasting permanence of this human nature of ours.

It is a far cry from the Egypt of the Pharaohs to the Russia of the Bolshevists, but a recent statement by Lenine carried our thoughts rather forcibly back to that Egyptian precept sculptured in the everlasting granite; for Lenine is learning in the school of bitter experience that there is no short cut by which human nature can be led out of the bondage of greed and selfishness into the promised land of the golden rule.

In a recent statement he has said: "What the Bolshevists have done so far was the easiest part. It was the destructive part. It required only force and decrees. The hardest part is still before them. Bolshevism will fail unless it can rebuild Russian industry and get maximum production." Lenine then explains that this cannot be done under the original plan of Bolshevism for the reason that the workers aren't yet willing to work for the same rate of pay for different kinds of work. "The machine worker still wants more than the man with a pick; and the brain worker still wants more than the machine worker. Russia will not have communism until human nature is changed."

"Until human nature is changed!" Aye, there's the rub! And with equal naïveté Lenine goes on to say, "It will take years to change human nature by education and to teach workers to run factories by Soviet methods. The only course before the Bolshevist leaders is to take a step backward from the Soviet state. They must call in bourgeois experts at large salaries to run the factories." Lenine then passes on to emphasize the need for placing the workers under iron discipline, making them subject in each factory to the will of one man, the "bourgeois manager."

And so the lesson of this last and greatest of all attempts to produce, overnight, an ideal social and economic world, is that the world climbs upward not by explosive outbursts of passion but by a process of well ordered evolution, based upon past experience and driven forward by the urge of lofty principles. "Learn," says the old adage, "to make haste slowly." In the long process of lifting this world from the rule of savage might up to the Golden Rule itself, we must remember that our individual lives, long-drawn-out though they may seem to us, are but as a tick of the clock in the evolution of a world; that a thousand years are but as a single day; and that the world does move onward and upward, even though inscriptions dug up from the sands of Egypt may seem to our impatient and weary minds to tell another story.

For a Bureau of Aeronautics

WE commend for careful consideration the bill of Congressman Frederick C. Hicks for the creation of a Bureau of Aeronautics in the Department of Commerce, to be presided over by a Commissioner of Aeronautics. The thought that runs through the bill is to centralize the material part of aviation in the hands of a board, while leaving to the military arms of the Government the training of their own personnel and the maintenance and operation of their own material. In this respect it differs from other bills which have been introduced, and it should in large measure reconcile the views of those who believe we should have a complete united Air Service, including Army, Navy and civilian construction and operation, and the views of those who would have the three entirely separate and independent. The bill is known as H. R. 14137 and we are of the opinion that such part of the public as secures a copy of this bill and studies it carefully will agree with us that, should the bill become law, it will do away with most of the present duplication of effort, without any effect of discouraging initiative.

The Aeronautic Board, appointed by the President, would consist of two members each from the Aviation Corps of the Department of War, and the Bureau of Aeronautics of the Department of the Navy; one member each from the Department of the Treasury, the Post Office Department, the Department of the Interior, the Department of Commerce, and the National Advisory Committee for Aeronautics. This Aeronautic Board will have authority to consider and recommend to the heads of departments concerned, on questions of policy, education, preliminary training, commercial production of aircraft, establishment, elimination and consolidation of all flying fields and air stations, and all other matters in which the several departments may be jointly interested. It will also have authority to assign all experimental and development work.

Although the board will have all programs for experimental research and development work submitted to it, the Army and the Navy will be free to prosecute independent experimental work in their respective services up to a cost of twenty-five thousand dollars. The board will also pass upon all types of aircraft, accessories and motors which are to be paid for with Government funds, before they are put into production. In a word, the new board will coördinate and standardize practises, specifications, forms of contract and matters of design, production and operation.

A most important provision and a wise one is that the commissioning, enlisting, training, et cetera of the aviation personnel of the several departments of the Government and the operation and maintenance of their aircraft shall be left under the authority of the several departments.

The Bureau of Aeronautics is to foster, develop and promote all matters pertaining to civil or commercial aeronautics, is to maintain landing fields other than military and naval stations, including those used for private or commercial purposes. Another important function is the designation of aerial routes, in which work the Commissioner of Aeronautics is to coöperate with the various states, cities and municipalities. In the Post Office Department there is to be created a Division of Aerial Mail Service; but in regard to this department as in regard to those of War and the Navy, all programs for new construction are to be submitted to the Aeronautic Board and passed before contracts can be let. The Board will draft rules for air navigation and traffic and will have under its jurisdiction the matter of issuing licenses.

As a compromise of conflicting views, this bill should meet with general approval.

Jane's Fighting Ships

THE restrictions of secrecy imposed by the World War wrought havoc, for the time being, with the various naval annuals, and, because of the great wealth of detail which always characterized Jane's Fighting Ships, that publication was particularly hard hit. Thanks to the generous policy of publicity which has been followed by the British Admiralty and the authorities of other naval powers, the issue of *Jane* for 1919 is a veritable storehouse of information for those students of naval architecture and equipment who, for several years past, have had to be content with a mere skeleton outline of the marvelous progress of the five years of the war.

The more important warships which were built for the British Navy during the war have already been described and illustrated in the SCIENTIFIC AMERICAN, and in the 1919 annual the whole program of construction will be found in detail with the usual photographs and line cuts showing the armor plans and the disposition of the armament. The displacement of the capital ships has been increased by the addition of tripod masts, director stations on the foretops, and searchlight towers, and in several cases by the addition of the bulge as a protection against torpedoes. Due to this, capital ships have increased by about 2,500 tons in displacement and light cruisers by about 600 tons. Noteworthy also is the increase in the crews, which are larger by about fifty per cent. A case in point is the "Renown," which carries a full complement of 1,500 men.

The British Navy has undergone a drastic reduction —all of her large fleet of predreadnoughts except two which mount the 12-inch and 9.2-inch gun, have disappeared, together with most of the earlier battle-cruisers carrying the 12-inch gun; so that today her first-line ships mount nothing smaller than the 13.5-inch and the 15-inch gun. Gone also are the armored cruisers and the early unprotected cruisers big and little; the earlier destroyers and a miscellaneous fleet of smaller vessels. Consequently the fleet as a whole is smaller, but thoroughly up to date. There is no new construction being undertaken; no program for battleships, battle-cruisers, destroyers or submarines is contemplated.

The practical elimination of the German Navy has caused the United States to move up to second place. In strong contrast to our former Allies, we have an enormous program of capital ships under construction. Our Navy has doubled in strength since pre-war times. We have completed eight battleships and have also some seventeen battleships and battle-cruisers under construction. We now have nearly 400 destroyers and 125 submarines, the majority of these being of new design and embodying the latest improvements in these classes of vessels. Six of our battleships will have a full-load displacement of fully 45,000 tons; they will have a speed of 23 knots and will mount the tremendous battery of twelve 16-inch 50-caliber guns in four 3-gun turrets. Their armor will be heavier than that of any existing ships and they will embody a system of internal subdivision that will enable them to take the blow of several torpedoes without being put out of action. The battle-cruisers will be of about the size of the "Hood"; will have two knots greater speed and will mount eight 50-caliber, 16-inch guns. They will have a novel arrangement of their armor designed to resist the effect of long-range, plunging fire.

The only other first-class power that has a program of new construction on hand is Japan. Her new work is on no such scale as our own; but it includes a few battleships and battle-cruisers of over 40,000 tons displacement. All of this work is being done in her own yards; for to her rapid strides in shipbuilding and ordnance construction, she is now independent of the foreign shipyards.

France and Italy have practically no capital ship construction on hand. Both navies have received some re-enforcement of their fleets from the allocation to them of ships surrendered by the enemy. Such new construction as these navies have in hand is mainly in the direction of scouts, gunboats and smaller craft.

A valuable section of the 1919 annual is that comprising a complete list of the ships lost by all the countries engaged in the war. Germany leads, as was to be expected; for to the long list of ships lost in the actual fighting of the war is to be added the great fleet which was scuttled at Scapa Flow. The next in total of ships lost is Great Britain, and a perusal of the names of the battleships, battle-cruisers, light cruisers, destroyers and submarines that were sacrificed bears tribute to her enormous share in the task of containing the enemy in his ports and keeping the seas open for the world-wide operations of the Allied forces.

A novel feature in this year's annual is the use of several photographs of warships, taken from the air, which afford useful details of deck arrangements.

Electricity

Electricity from Small Streams is the title of a recent publication issued by the Department of Agriculture. A. M. Daniels, assistant mechanical engineer, division of rural engineering, Bureau of Public Roads, is the author. This booklet comprises 20 pages and discusses in their respective order: Latent sources of water power; plants within reach of thousands; estimating the amount of power required; water power principles; measuring the stream flow; and power from small streams.

Locking the Lamp in the Socket.—A New England manufacturer has recently introduced an ingenious socket which locks any incandescent lamp placed in it. The device which does the locking consists of a small metal pin with a triangular head, which screws through the porcelain base, being threaded into a hollow screw which fastens the socket on to the porcelain. It is claimed that this safety device positively prevents lamp stealing, as it is next to impossible to remove the lamp without a special tool. The pin does not project above the porcelain base and therefore cannot be removed by a pair of pliers or similar tools, and the entire device is concealed by the socket cap.

Simultaneous Radio Transmitting and Receiving.—A system of simultaneous reception and transmission for radio telephony is described together with the reasons for its use in a recent issue of the *Proceedings* of the Institute of Radio Engineers. It involves transferring the received speech (from a separate receiving antenna at some distance from the transmitting antenna) to the subscriber's line and transferring speech originating at the subscriber's station to the radiophone transmitter. Another type of duplex radio communication suggested by Ernst F. W. Alexanderson is based on nearby receiving and transmitting antennæ so arranged with their associated apparatus that the receiver and transmitter are in conjugate branches of a Wheatstone bridge. The wiring of the bridge is given and the apparatus shown.

Steel-Cored Aluminum Conductor.—We learn from *Elektrotechnische Zeitschrift* that a number of important high-tension transmission lines erected during the last three years in Germany have been fitted out with aluminum conductors of the steel-core type. The author warns emphatically against the use of non-reinforced aluminum wire and recalls the frequent accidents with the brittle copper conductors of earlier days. In normal times, he says, the aluminum conductor itself will be more expensive than copper of corresponding size, and since the poles must be built for a higher side-ways pull owing to the large diameter of the wire, the aluminum transmission line will in general not stand the competition. However, the steel-core aluminum conductor is of great importance in certain special cases, such as river crossings, etc., and when the so-called long-span system is resorted to. This system is characterized by very high towers with long spacing and may prove highly economical in cases of right-of-way difficulties and for voltages where the insulator cost is very high.

Hot-Wire Telephones.—Thermophones are actuated by heat instead of electro-magnetism, and hence their characteristics are different from those of the usual telephone receivers. Speech is reproduced in the receiver by the motion of columns of air adjacent to the small heated wires. In this case the diameter of the wire is of great importance, and it is well to consider the relationship between the watts in the wire and the diameter of the wire, the London *Electrician* goes on to say. It is readily understood that with very thin wires the great area of radiating surface as compared with the small cross-section allows the heat generated by the current to dissipate very rapidly. This property is made use of in the construction of thermophone receivers. The hot-wire receiver will only respond to the transmitter to which it is connected. When speaking it is necessary to speak close to and into the transmitter mouthpiece for the best transmission. Inductive effects are absent and, there being no diaphragm, there is no inherent distortion. The instrument has the great advantage of responding perfectly to low-spoken tones or whispers, and if the voice is raised there is no clash or confusion of sounds. It is extremely light in weight, from 0.25 to 0.5 oz.

Astronomy

New Astronomical Journal in Scandinavia.—The latest addition to the list of astronomical periodicals is the *Nordisk Astronomisk Tidsskrift*, published in Copenhagen. Its three editors represent Denmark, Norway and Sweden; viz., J. M. Vinter-Hansen, Copenhagen; J. Fr. Schroeter, Kristiania; and Walter Gyllenberg, Lund.

The Number of Spiral Nebulæ.—On the basis of photographs of spiral nebulæ which he has recently taken with the Crossley reflector at the Lick Observatory, Dr. Heber Curtis estimates that the total number of these objects in the sky and within the range of celestial photography is between 700,000 and 800,000. The greatest number found on a single Crossley plate, corresponding to an area of about nine-tenths of a square degree, was 304.

The Solar Eclipse of Sept. 20, 1922.—British Astronomers are making plans for observing the total solar eclipse of Sept. 20, 1922, when it is proposed to repeat the investigation of the Einstein shift. There will be a number of observable stars near the eclipsed sun, though they are much less bright than those observed during the historic eclipse of 1919. Proposed locations for stations include one of the islands of the Maldive Archipelago, Christmas Island (south of Java), and points in the interior of Australia.

The Trans-Neptunian Planet.—In a recent popular article on this still undiscovered body, Dr. Eric Doolittle states that according to one of the latest calculations, based upon disturbances in the movement of Uranus, the hypothetical planet lies at a distance of nearly 4,000,000,000 miles from the sun and occupies 283 years in completing its circuit around that luminary. Its mass, according to this calculation, is about six times that of the earth, making it much smaller than any of the other planets that are remote from the earth, and correspondingly difficult to observe. It is believed that, when discovered, its brightness will not exceed the twelfth or thirteenth magnitude. The calculation quoted places the planet, at the present time, near the western border of Gemini.

A New Type of Spiral Nebula.—The Lick Observatory has published a descriptive list of 762 nebulæ and clusters photographed with the Crossley reflector by Dr. H. D. Curtis. One of the two plates contained in this work shows photographs of a new type of spiral, of which 23 examples are included in the list, so that the type must be rather common. Dr. Curtis says: "Its main characteristic is a band of matter extending diametrically across the nucleus and inner parts of the spiral. Frequently the whorls in this type form a nearly perfect ring; in other examples the whorls appear to begin at the ends of this cross-arm. The general appearance is that of the Greek letter *phi*, and I have termed such objects *phi*-type spirals for the lack of a better name."

New Photographs of the Infra-Red Solar Spectrum.—In the *Publications* of the Astronomical Society of the Pacific, Dr. Keivin Burns presents an account of his work in photographing at the Lick Observatory the solar spectrum far in the infra-red; viz., between 9,000 and 9,900 A, and his attempt to identify the lines in that region. His paper is accompanied by a reproduction of a spectrogram beyond the limit of the region photographed by Meggers in 1918; it extends from 9,600 to 9,900 A. The photographic plates were sensitized by means of dicyanin furnished by the U. S. Bureau of Chemistry. Dr. Burns reaches the general conclusion that in the region 9,000 to 9,250 A there are few, if any, lines of solar origin of intensity 0 or greater on Rowland's scale, and beyond 9,250 A it is almost certain that all the strong lines seen in the spectrogram are due to absorption in the earth's atmosphere. He remarks that the region beyond 9,000 A will perhaps always be of small interest, considered as part of the solar spectrum, but is sure to be of interest in studying the absorption lines due to the gases of our own atmosphere. We cannot distinguish at present between the lines due to the various gases of the atmosphere. However, many lines have different intensities on different plates, and this suggests that they are due to water vapor, the only markedly variable constituent of the atmosphere.

Aeronautics

That Handley-Page Wing.—It is stated unofficially that the new type airplane wing to which Mr. Handley-Page referred in his recent talks both here and abroad, as permitting the wing area of machines to be reduced to half the present size and yet possess the same carrying capacity, has been tested independently at the National Physical Laboratory of England, and the tests are said to have fulfilled the claims made by Mr. Handley-Page for the wing.

China's Handley-Page.—The twin-engined Handley-Page airplane supplied to China recently made its official flight with representatives of the Chinese Government on board. The machine left Nanyuan airdrome at 2:15 P. M. with fourteen passengers and 1,200 pounds of sand which acted as a test load. After climbing to 6,200 feet, three circuits of Pekin and the surrounding country were made, the machine diving three times in salute over the President's palace. The engines and the machine are reported to have behaved splendidly throughout the flight in spite of the intense cold which prevailed at 6,000 feet.

Flying Taught on the Ground.—To simplify the training of airmen, it appears that Germany developed a machine very much along the lines of our Ruggles Orientator. The German device, which is the invention of Engineer Franz Drexler of Berlin-Friedenau, consists of a swing or see-saw, on which both instructor and pupil sit. This apparatus is worked by an electric motor and is controlled entirely according to the desire of the instructor. It is worked by a lever and can, at will, turn, swing, dip on one side or the other, be brought out of balance, and so on. Pupils can practice with bandaged eyes so that they reproduce the conditions of flying in fog, through clouds or in darkness.

Italian Airships in the War.—Of the 25 airships possessed by Italy during the war, 12 met with a tragic end. The V-1 was brought down by artillery fire at Pola, in August, 1918. The P-6 was burnt in its hangar at Campalto; the M-2 was brought down by airplane and gunfire after a raid over Fiume; M-3 and M-4 were brought down by artillery; M-5 was burnt at Turin as a result of a collision with an airplane; M-7 was lost in a storm; M-8 was hit by Austrian fire while in its hangar, and M-13 suffered the same fate; M-10 and M-12 were brought down by artillery fire, and lastly, M-17 fell into the lagoons near Venice, having been hit by anti-aircraft artillery on the night of February 3rd, 1918.

Again, German Efficiency.—During a series of experiments with the Fokker, the Engineering Department of the First Pursuit Group at Kelly Field, Texas, found to its surprise that the plane was covered with non-inflammable fabric. The material used in this test was a piece of covering from the standard D-VII Fokker wing which, when exposed to the flame of a blow-torch, showed that fire-proofing had been accomplished to such an extent that even though the torch was held at one spot a considerable time must elapse before a hole appeared and there was no spreading of the flames to larger areas than that covered by the blow torch. Many early German planes on the front went down in flames, continues *Aerial Age Weekly*, and the systematic Germans did not take long to remedy this condition.

Bakelite Propeller Test.—Major William Ocker, flying a DH-4 Goldbug from Aberdeen, Md., to Washington, D. C., equipped with the new Micarta or so-called Bakelite propeller, put this propeller to a most severe test. Bolling Field had been in a very bad condition for about two weeks, the mud being 12 inches deep. Landing with a DH-4, which has a very high landing speed, in mud is a particularly dangerous undertaking. Hardly had his wheels touched the ground when his plane nosed over. Before he could reach the switch to cut off his engine the propeller succeeded in churning around in the ground several times. The force of this churning was so great that it threw his plane back into position, while the wheels sank down to the hub in the mud. When an examination of the propeller was made it was found to be in perfect condition and not even chipped. If this had been a wooden propeller it would have been broken into match sticks.

Sounding with Sound

How the M-V Type of Hydrophone Developed for U-Boat Detection Now Serves the Peaceful Mariner

By Harry A. Mount

THERE is hardly a branch of science which has not come out of the war advanced by a great stride. And it is particularly fitting that many of the great scientific discoveries and inventions designed for destruction are now being turned to account in peaceful commerce and in the saving of human lives.

Thus, one of the most effective weapons used in curbing the U-boat menace now promises to safeguard our ships from many of the heretofore common dangers of navigation. The invention referred to is the M-V type of hydrophone, developed for submarine detection by the U. S. Navy, which has been released for commercial use because it has been found to be a remarkable aid to the mariner. The opinion is ventured that very soon every sea-going vessel will carry these instruments as a part of the indispensable equipment. Many important uses have been found aside from its war application, and experiments are still in progress.

One point alone would justify the widespread adoption of the M-V hydrophone; it will make the ship practically as safe in fog as in clear weather. This is because the device accurately locates and can tell the direction and course of all nearby vessels, whether or not they can be seen. Other vessels can easily be located in time to avoid collision and the ship can proceed full speed with absolute assurance of safety.

Lightships equipped with submarine bells, at harbor entrances and at points of danger, can be located at distances of fifty miles and bearings taken from them when the ship nears the coast in a fog. The depth of water under the boat can be determined any moment while the boat is moving at full speed. Icebergs and other obstructions to navigation can be located in time to avoid collision.

Added to all these virtues, the M-V hydrophone has the advantage that it can be quickly and comparatively cheaply installed; it is "fool proof" and rugged in construction, and can be operated by any seaman of ordinary intelligence after half an hour's instruction. Recognizing the commercial value of such a device, the Navy Department has consented to its manufacture. A New York maker of ship safety devices has acquired the patent rights from the men who designed it and a production program is already under way.

The M-V hydrophone gets its name from the words "multi-variable" and suggests the method used in procuring the remarkable results noted. In its present form, the hydrophone consists of twelve microphones exposed to the water in a row along the ship's bow. Wires from these microphones lead to a "compensator" located on the ship's bridge. The action of this "compensator" really is the crux of the whole thing and it will be explained presently. In outward appearance it is simply a housing or box on top of which is a hand wheel. There is a slot in the top, through which are visible three rows of figures on a dial. One row of figures indicates angle to port, another angle to starboard, and the third row is calibrated to read in fathoms of depth. There are two head receivers of the common telephone type.

Supposing we wish to determine the depth of water under the ship. We put on the head receivers and listen to the sound of our own ship's propeller. By turning the hand wheel back and forth, we apparently cause the sound to travel back and forth before us and there is a point where it is loudest. When this point is reached it is only necessary to read the depth in fathoms from the dial.

Likewise if the position of a nearby ship is to be found, we have simply to listen to her propeller and to note the angle to port or starboard as registered on the dial.

The instrument depends for its operation on the fact that a sound coming to the ship from an angle does not strike all of the underwater microphones at the same time. It must be remembered, however, that sound travels under water about five times as fast as in air, so that the time which elapses while the sound travels from the first microphone in the row to the last is very slight. In fact if the sound received by all twelve microphones is transmitted to the ear, there is no noticeable break. But it is apparent that if the sound from the first microphones could be delayed slightly, and the sound from each succeeding microphone delayed a little less, so that the combined sounds from all the microphones reached the ear at precisely the same moment, a very much louder sound would be heard. That is precisely what the "compensator" does. It delays the sounds from some of the microphones and the amount of delay can be varied by turning the hand wheel. The hand wheel is always in a certain position to receive best a sound from a certain direction, so that it is only necessary to attach a dial and note that position on it in order to locate a sound from that particular direction again.

The instrument, as first designed, was not an electrical machine, but a purely acoustical one, the sounds taken from the water by diaphragms being carried directly to the ear by tubes. The instrument is most easily understood in this form. The underwater receivers in the M-V machine were used in sets of three, as indicated in Fig. 5—1. Referring to this figure, if a sound were coming from the direction indicated by the arrow it would first strike receiver 1, then 2, then 3.

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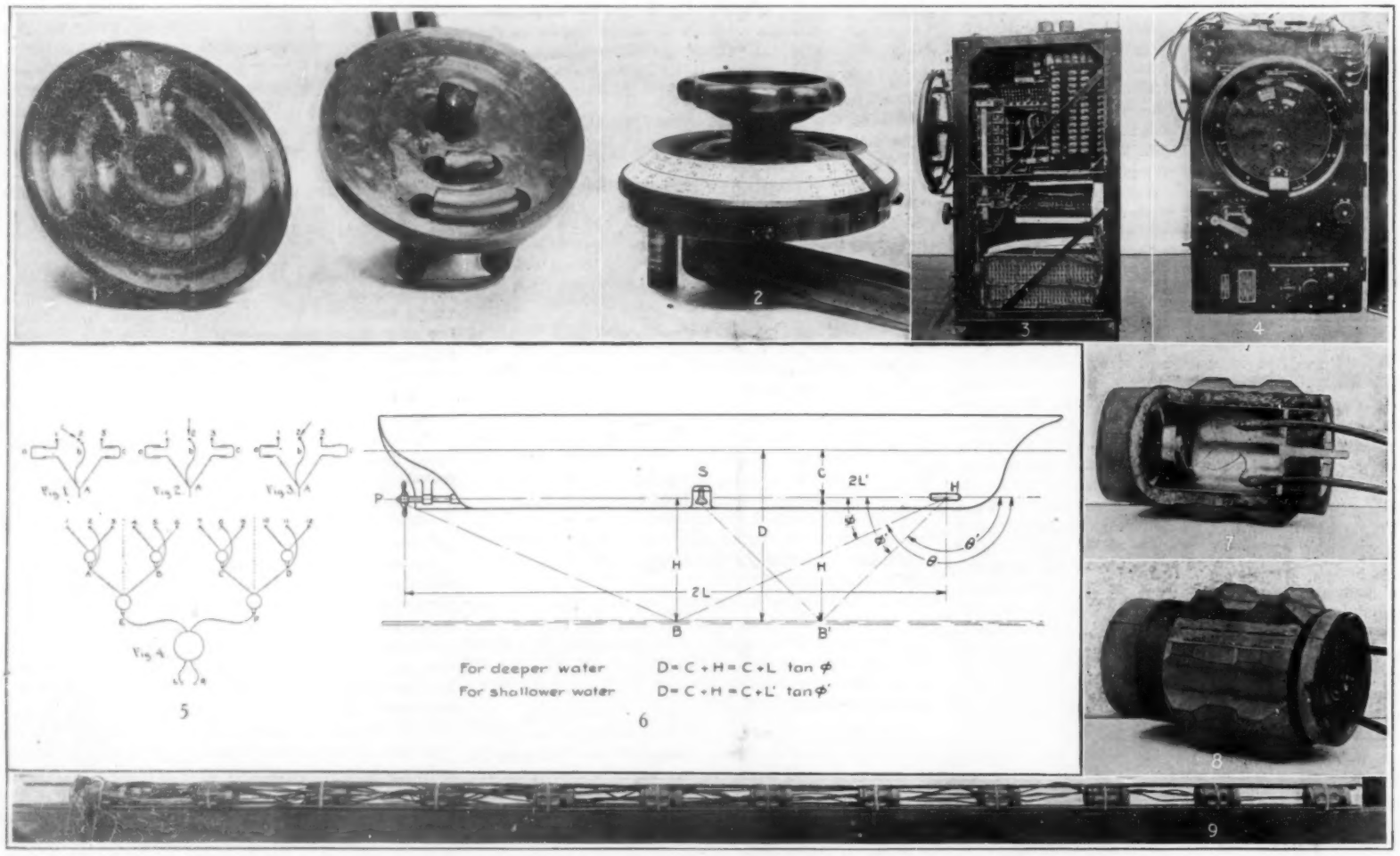


1. Disassembled view of the two-spot acoustic compensator. 2. Assembled view of the two-spot acoustic compensator. 3. Interior details of electric compensator. 4. Front view of the electric compensator used in conjunction with the "eel" or a line of microphones mounted on the vessel. 5. Method of using the plain acoustical hydrophone. 6. Schematic explanation of how soundings are taken by means of reflected sound waves. 7. Microphone in section, showing its mounting upon the rubber diaphragm. 8. Microphone unit in its housing. 9. A line of twelve microphones assembled for insertion into an elongated rubber housing known as an "eel," or within a watertight compartment for an on-board installation.

Some details of the apparatus employed in an M-V hydrophone installation for peace-time navigation purposes

Making the Milkman Fear the Pump

By James Anderson

FOR the past few years the milk problem has been of the greatest concern to the poor of our large cities. Milk has risen in price until in many families it is a luxury instead of the necessity which nature made it. On top of this, it is one of the most easily doctored of foods. A liquid, in its natural state there is a considerable percentage of water in it. It is a simple matter for the unscrupulous dealer or producer to add a little more water than the cow gave, thus increasing the volume of his sales. Heavily watered milk is bluish white in color, but this is equally true of the lower grades of pure milk, and thus serves as an alibi to dishonest dealers in cheap milk, which in the very nature of things cannot be high-grade milk.

With the aid of an apparatus recently devised by Julius Horvet, of the Minnesota Dairy and Food Commission, however, it is going to be possible within the space of a very few minutes to state just how long the wily dealer in trick milk has worked the pump handle, or allowed the product of the dairy to remain unprotected in the April showers. The cryoscope, as the new apparatus is called, works on the basis of the difference in freezing point between water and milk; and it will determine infallibly whether the consumer is receiving pure milk or watered milk, or pure water to which a little milk has been added.

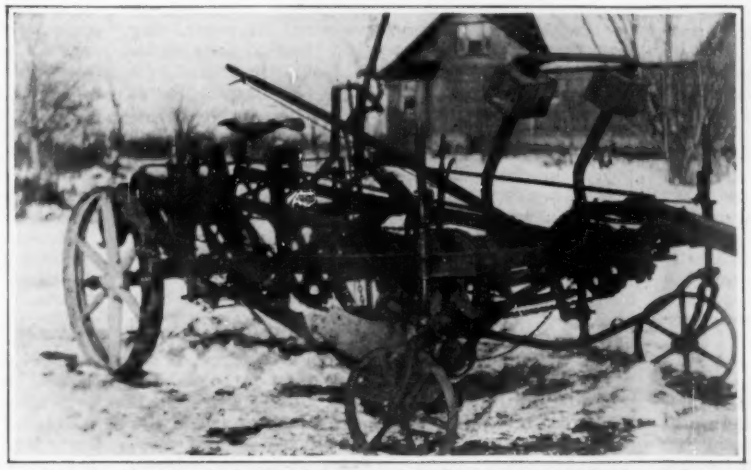
The pure-food law can define good milk in hardly other terms than as milk got from clean and healthy cows, and sold without addition or subtraction of ingredients. For the law cannot define high-grade milk, it can only define edible milk. And under such a definition the operations of nature make it certain that pure milk—normal milk from normal cows—will exhibit wide variations in composition.

In addition to its fats, milk contains other solids, milk sugar, protein and water; and all of these elements it contains in varying proportions. The percentage composition of milk varies so widely that in many cases it is not possible to determine by chemical analysis whether the product is pure or not. Especially does analysis fail when comparatively small amounts of water have been added to the milk. The most serviceable of the well-known methods that have been commonly applied is not claimed to yield conclusive results indicating the addition of smaller amounts of water than ten per cent; in many cases it has failed to demonstrate adulterations extending into higher figures. The commercial practice of standardizing milk—that is to say, reducing the butterfat content, by addition of skim milk or water, to a certain limit prescribed in state or municipal food laws—has given rise to a lot of mischievous practice. Cases are known where the milk is actually freed of the last vestige of fat content in the separator and enough then restored to make it meet the standard set by the law.

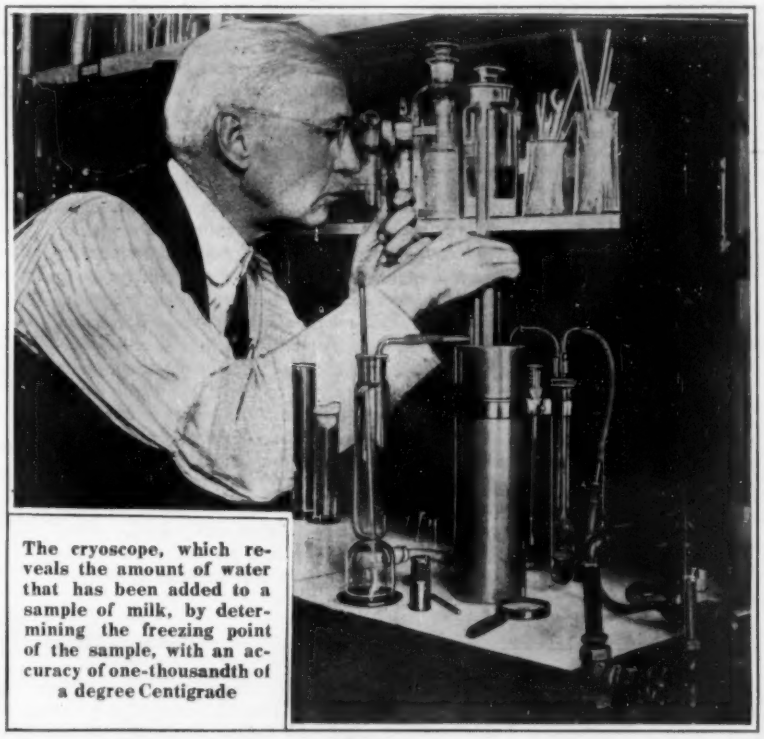
From fundamental principles it appears that the freezing-point test furnishes the most reliable criterion whereby to judge the purity or genuineness of a sample of milk. For European investigators in the latter part of the nineteenth century established that whole cow's milk from different herds has a freezing point which varies between extremely narrow limits. Whatever its water content, it freezes at a little more than one-half degree below Centigrade with an average of —0.55 degrees. The only important exceptions are to be found now and then in the case of unhealthy animals, those which are not properly nourished, and those which have been milked under inadmissible conditions. The constancy of the freezing point is especially marked in the case of mixed samples obtained from numerous individuals or even from several herds.

Accordingly an accurately determined freezing point for a sample of milk has been accepted by Federal investigators as reliable indication of added water below five per cent, while the Minnesota authorities be-

(Continued on page 659)



The machine that is designed to cut and top beets, an operation heretofore always performed by hand



The cryoscope, which reveals the amount of water that has been added to a sample of milk, by determining the freezing point of the sample, with an accuracy of one-thousandth of a degree Centigrade

A mower attachment for the light tractor

Machinery for the Sugar-Beet Field

By W. F. Wilcox

THERE is a great deal of hard, irksome toil associated with the production of sugar beets. A great deal of this work must always be done by hand and until now the topping has always been hand work. A new machine which the inventor says will be at work in every beet-producing section by next beet harvest will exceedingly simplify and expedite the work of harvest. Heretofore a man with three horses on a beet "puller" has loosened the beets at the rate of two and a half acres a day. Then it was necessary for a man to go along and finish pulling each separate beet by hand and throw it out in a pile. This was a slow, hard, back-breaking job. Then after the beets were piled with the tops on, a man, woman or child came along with a big beet knife, sat down beside the pile, grabbed up a beet in the left hand and with a tremendous whack of the giant knife, severed the top from the beet at the proper point and then threw the topped beet into a pile.

The great trouble which all inventors have had in perfecting a beet topper is to get the thing adjusted so that it will top each and every beet at the proper place. One beet will stand six inches above the surface of the ground. The next one may be an inch below the surface, the next one an inch above and so on. There is a certain kind of acid in the top and in the extreme upper portion of the beet that must be got rid of or it counteracts the sugar properties and lessens the amount of sugar produced. The top must be lopped off low enough to get rid of this and yet not so low as to waste any of the beet. Inventors have been agreed that the beets must be topped before they are dug but how to adapt a machine to the various growths has been a problem. Kramer's machine is equipped in front of the digger with a revolving disk 20 inches in diameter, so adjusted with a spring and a roller in front of the disk that it measures the cutting distance from the top of the beet instead of from the ground. Just so much of the top must be cut off and no more. It is claimed that this machine will cut the top off at the proper place and more squarely so as to save on the beets over hand topping. The disk in itself has two motions, the forward one of the machine, which in itself would cut the top; but by revolving at a high rate of speed, the topping is done much better.

The disk is so arranged that it cannot be choked, having been tried out in fields where the Russian thistles were thick and no trouble was experienced. Immediately behind the disk are two beet lifts or pullers which lift the beets from the ground and deliver them on to an endless chain elevator that dumps them out behind the machine freed from dirt and clods.

Then a man comes along and loads them on to the wagon. The machine is heavily made so as to stand up under the strain in all sorts of soil. It has been successfully used in soil that was wet and muddy and in soil that was hard, dry and packed almost like cement.

It is on the general plan of a potato

(Continued on page 659)

Mowing with the Tractor

AN ingenious attachment has just been perfected for the light tractor, consisting of a mower attachment which hitches on to the side of the machine with little effort. The attachment is simple and comparatively low in cost and whenever a tractor owner wishes to cut hay he simply hitches it on to the side of the tractor and cuts at the rate of 20 acres a day, it is said. The length of the bar is eight feet and the driver of the tractor has control of it and is enabled to operate both tractor and mower very easily.

Succeeding in Radio Engineering

One of the Newest of Professions, and One Well Worth the Attention of the Man with the Pioneering Instinct

By Raymond Francis Yates

PROBABLY no profession has advanced more rapidly or has come into prominence more quickly than that of radio engineering. It is the infant of the engineering sciences. It has only been during the past fifteen years that the radio engineer has come into his own.

The writer feels greatly indebted to Dr. Alfred N. Goldsmith for his many suggestions which have been embodied in the subject matter of this article. Dr. Goldsmith is one of the pioneer radio engineers and indeed his work in this field has earned him the title of radio scientist. He is Director of the Radio Research Laboratory at the College of the City of New York and President of the American Institute of Radio Engineers. Aside from this he is Consulting Engineer for the Marconi Wireless Telegraph Company. Probably no man is better qualified to outline the radio engineering field to young men than Dr. Goldsmith.

No engineering profession has a greater future than that of radio. The radio era is upon us and the world is just waking up and rubbing its eyes. During the war developments that would have otherwise extended over a period of fifteen or twenty years were crowded into several years. Things that were impossible in radio previous to the war are now practised daily. The sensitivity, reliability and application of radio telegraph apparatus has been increased almost beyond belief. The human voice has been transmitted across the ocean with perfect ease and many other equally wonderful things have been done that were utterly impossible just a few years ago.

It will not be long before we will be able to talk wirelessly from our homes to any part of the country. Every telephone exchange will have a powerful wireless telephone transmitter and a sensitive receiver and it will be possible to connect private telephones to this transmitter and one can then talk to any part of the country. The party being spoken to will be connected to the receiver and transmitting equipment of his local exchange and in this way the whole country will be linked together wirelessly. This is a development which is sure to come and one that will be readily received and welcomed by the world. Wireless telephony has been developed to a point of efficiency where this is already practical.

"Of what value is a radio engineer to his country?" Dr. Goldsmith was asked. He replied that he assists his country in keeping in touch with the world and in this way does much toward fostering commerce. The radio engineer and radio operator also help the citizens of their country to travel with safety on the sea. Then, too, the radio engineer and operator enables the country's naval forces and military forces to be controlled from the governmental headquarters. The radio engineer is important in both war and peace times.

Education will now be considered. It is the belief of Dr. Goldsmith that a radio engineer should at least have the equivalent of the full university electrical engineering course and this should be supplemented with elected courses in telegraph and telephone engineering. Moreover, he must have wide practical experience with a large radio corporation before he can be regarded as being a fully qualified engineer. From this it will be seen that the radio engineer must be a very learned man with thorough training in several distinct, but, on the other hand, closely allied, branches of engineering. The radio engineer must be a mathematician, as much of his work will have to do with higher mathematical calculations. He must be able to apply trigonometry and analytical geometry. He will also be severely handicapped if he does not have a knowledge of calculus and differential equations, which are used continually in radio calculations.

This brings up the question, "Can an ambitious young man qualify for a radio engineer's position without a thorough college training?" As in all other things much depends on the man. Probably about one per cent of the men who train themselves outside of college can ever attain prominence in the field. The writer has in mind a number of young men who are radio engineers and who are self-trained, but they do not hold extraordinary positions. However, they draw good average salaries and their work is by no means irksome or unpleasant in any way.

In settlement of the question of a college training it can be said that an exceptional man can succeed in any field practically by educating himself. He will, however, work under a tremendous handicap and most men would be unable to keep abreast of the present remarkable development in advanced radio engineering without a university education.

When Dr. Goldsmith was asked what he thought of the future of radio engineering as a profession, he remarked that it holds great possibilities for really able men; men above the ordinary. For the average fellow, he said that he believed that the field would be disappointing. The radio field is in its infancy and the complex nature of the work and its continual evolution require pioneers of unusual ability. It must be remembered that the foundation of radio science is now being laid and development work must rest with highly trained men capable of coping with new problems of complex nature. In other engineering sciences matters are different and men of ordinary ability have a much better chance to increase their earning capacity as well as rank.

A young man entering the radio engineering field must have, in addition to a good technical training, an alert intelligence, much determination, a willingness to work all sorts of hours in the performance of important research work, and a strong physique. The latter qualification is necessary as oftentimes radio engineers are called upon to erect stations in remote parts of the world and this requires great endurance. Stations are being erected in every conceivable corner of the globe; in the torrid south and the frigid north. In fact, one of the greatest things wireless has accomplished is the bringing of remote spots in touch with the rest of the world. In this particular phase of radio engineering there is considerable romance and adventure especially for unmarried men.

What is the present and future demand for trained radio men? This is an important consideration for the chap contemplating a radio career. Dr. Goldsmith believes that the demand for thoroughly qualified radio engineers will always be reasonably large, but he does not believe that the demand for assistants will be greater than the supply now available for a number of years. At the present time there are a great number of men who are capable of acting as assistants to real engineers. A number of these men pose as experts and engineers but few are deserving of the title. It must be remembered that a great number of amateurs follow radio as a hobby. Some of these men become rather proficient in the art and when they reach that point where they are capable of talking about microhenries, inductance, capacity, impedence, reactance and the like, they are very apt to overestimate their learning and call themselves radio engineers when they are really rank amateurs. There are really few honest-to-goodness radio engineers who are not holding good positions with the large corporations. Radio engineering, is a hard, cold science requiring a great amount of training; and any amount of text-book reading with a little experimenting with amateur apparatus will not qualify one for a radio career. It is the great number of advanced amateurs today that makes the demand for this class of men less than the supply. Unless one decides to enter the field and to learn the work from a to izzard there is not a really promising future in radio engineering.

The opportunity for a radio man's going into business for himself and succeeding is not very great. There is absolutely no chance for a consulting engineer as all the really worth-while companies have their own engineers. The chance for a radio manufacturer is somewhat small in both the amateur and commercial field. The amateur field is simply overcrowded and keen competition exists in the commercial field. It is Dr. Goldsmith's opinion that the majority of radio engineers of the future will not go into business for themselves but will hold responsible and remunerative positions with the large radio corporations.

Radio engineering today shows marked signs of splitting up into special branches and there is sure to be a future demand for men who have specialized in high-power station erection, radio telephony, etc. Today the demand for specialists along various lines is not great but as the field expands and develops this demand will become greater and greater.

Today but few of our colleges and universities are able to give anything but an outline course in the science of radio engineering. The development of really suitable courses in the universities is in its infancy and it will probably be a number of years before this branch of engineering will be taught with the same thoroughness as the other engineering courses.

When the writer asked Dr. Goldsmith what the ambition of every radio engineer should be, he said:

(1) Through intelligent hard work to improve apparatus and methods in the radio field.

(2) To affiliate with his fellow engineers for the spreading of knowledge and the welfare of the art and the workers in it through properly organized engineering societies.

(3) To attain as responsible a position of maximum usefulness to his company as he is capable of filling.

(4) To be prepared to assist the government of his country in carrying out radio projects at any time.

The salary in the radio engineering field will be a disappointment to those who hold this to be one of the most important considerations in their choice of a profession. To those who honestly believe that their future is in radio, the salary will be the least important item.

The young engineer just leaving college cannot expect a salary over $1,500 per year to start. This salary, unless unusual ability is display, will probably continue for several years while much needed experience is being gained. What is true of radio is true of all the engineering fields. Experience is absolutely necessary and moreover it must be paid for. The salaries of radio men now extend anywhere from $1,500 to $20,000 per year for a few of the most highly trained men. The writer is acquainted with several young radio engineers who are not college men but who have advanced themselves to a point in the field where their earning capacity has reached $4,000. The writer also knows that these men have worked hard and studied. This, with the advantage of working in a radio laboratory finally advanced them to a point where they could withstand the competition of college trained men working at their side.

For the truly inventive mind, the radio field holds wonderful possibilities. Although radio communication has advanced tremendously within the past few years, many extremely important problems are yet to be solved and the capital at present involved in the field gives assurance of ample reward for those who actually succeed in solving any of these problems. The larger radio corporations maintain exten-

(Continued on page 660)

IN all the major branches of engineering which have for many years been recognized as distinct there is the tendency toward specialization. Few are the men who permit their operations to cover the entire field of civil or mechanical or electrical engineering. But for the best part, a specialist in some branch of civil or electrical or mechanical engineering is still known to the public as a civil or an electrical or a mechanical engineer. An exception, however, is usually found in the case of a comparatively new branch in which it is very obvious that there is a vast amount of special work to be done—especially when this branch is of a sort to appeal to the popular imagination. The railroad and the telephone are familiar; many of us would hesitate to recognize railroad construction or telephone work as a distinct branch of engineering worthy of a name of its own and separate discussion in a series such as the present one. But in a different class stand professions, like automotive engineering and aeronautical engineering, which by their brilliant achievements of recent years are still fresh in the public consciousness. With these two, no doubt, the field of radio engineering can stand on even ground. There can be no hesitation in acknowledging this as a distinct profession—and little in agreeing with Mr. Yates that it holds forth great opportunities to the man who is minded to pursue them.—THE EDITOR.

The Scientific Basis of Carelessness

An Unrecognized Danger of Allowing Habit to Superintend Our Acts

By D. H. Colcord

WHEN a man deliberately steps into the street directly in front of a moving automobile and is injured, bystanders assign *carelessness* as the cause of the accident, whereas the real basis for his apparent lack of judgment may be buried deep in his nervous system. Thousands of accidents of a similar nature which occur every year and appear to be preventable are in reality caused by a physiological condition over which the victim has no control. A nervous reflex located in the muscles often is more powerful in an emergency than man's higher brain centers, and is at all times a treacherous asset.

To carelessness is assigned the majority of industrial accidents, which total alarming figures, notwithstanding the advance in the science and art of safety engineering. When is a preventable accident due to carelessness, and, furthermore, when is a man actually careless? With analysis it will be found that the instances are rare when an employee who has been injured or killed has failed to "care" for his safety—statistics to the contrary notwithstanding.

Briefly stated, in a careless moment the attention becomes fixed and the judgment suspended because all of the controlled motor activity of the nervous system is held in abeyance during a period while a set chain of habits is running its course. The period may be but an instant of time or it may be several minutes; in any case, of sufficient length for a sleeve to be caught or a punch-press to fasten the hand. The sensory nerves are functioning, messages of warning are flashing to the brain-centers; but reaction is delayed.

Did you ever start to change your collar before dinner and find that you had, from force of habit, removed several other articles of apparel before your attention was arrested? Have you ever gone to the bathroom for a drink of water to find yourself a moment later with a razor in your hand? You can find any number of instances from these suggestions wherein daily you perform some act deliberately and find yourself in the midst of a second or third act that has by habit accompanied the first. A prominent industrial surgeon told me that occasionally men burned themselves with apparent deliberation, the movement that produced the injury being a unit in a habit-series. A man operating the levers of a crane, pouring a heat, oiling a lathe in motion, driving an automobile, or crossing a crowded thoroughfare, may at a dangerous moment continue to act as accustomed by habit, thus occupying the nervous machinery with habit-chains which prevents conscious control. The more highly skilled a workman becomes the more liable he is to such a lapse of attention accompanied by unconscious activity.

A correct analysis of the neurotic state of the injured at the time of the action would charge the responsibility to *skill* rather than to *carelessness*. The man has relegated to the lower brain centers control of the thousands of acts that function in series. The automatic connection that is made between separate acts in serial action sets in, and although valuable as skill, may prove to be his undoing in an emergency. To perform one act touches off the series. Animals are not careless—they are always at attention, being unencumbered with automatic complex muscular coördinations.

What is there about the function of our nervous system that creates the serial action or chains of habit? Curiously the organ that furnishes the link in the chain is located in the muscles. It is man's sixth sense. The movement of a muscle stimulates nerve end-organs located beneath muscular tissue. The end-organ here transmits the stimulus to the sensory nerves. The nerves carry it to a nerve center, which redirects the message, transmitted over the motor nerves to the muscle and a second act results. The same process may act and react indefinitely until the action is performed. For instance, one *sees* that a steel cylinder has been cut to the mark on a milling machine—an arm moves to stop the carriage—the movement of the arm muscle stimulates the muscular sense which "touches off" a leg movement to kick open a switch to stop the motor—the kick sets up a nervous transmission that moves the arms to release the piece of steel, etc., etc. This repeated a hundred times becomes automatic, habitual, unconscious—the sixth or muscular sense furnishing the connecting links. It is then easy to conceive of a number of situations where men have been injured due to an extra uncontrollable movement in a habit series.

One solution for the problem of "Injury Due to Carelessness" would be to change an employee's environment in the shop occasionally. To allow a man to work too long at one machine with one series of actions jeopardizes his safety. He becomes a slave to habitual coördinations. Safety-first signs must be changed frequently in design and effectiveness. Their particular location should not be constant. To teach safety is to make a man a better animal—to break up a tendency to nervous plasticity and to make habits more flexible.

The Amateur Star-Gazer

THE Spring Meeting of the American Association of Variable Star Observers was held in New York in May. There were thirty members present.

The David B. Pickering Medals were awarded Miss Ida E. Woods and Miss J. C. S. Mackie of the Harvard College Observatory staff, in recognition of their photographic discoveries of new stars.

Papers relating to investigations of stellar variation were read by President Leon Campbell of the Harvard College Observatory, and Mr. Irvin L. Murray of New York City.

The Association has lately received valuable sets of lantern slides from Dr. George E. Hale, Director of the Mt. Wilson Observatory and a similar gift from the Lick Observatory. The collection of slides now numbers 350. These are available for lecture purposes to any member of the Association.

Founded in 1911 with seven members the Association now has a membership of 179, including 18 life and 11 honorary members. During the past nine years its members have made over 100,000 observations of variable stars, all of which have been published in *Popular Astronomy*. During the past year 350 variable stars were observed.

The Association possesses eleven telescopes which are loaned to deserving members. More telescopes are needed. Anyone who has a glass that is not being used, and who wishes to do some practical observing, or knows of an instrument that the owner would like to dispose of, will confer a favor by informing the corresponding secretary, Mr. W. T. Olcott, 62 Church street, Norwich, Conn.

The Association extends an invitation to all those interested in practical telescopic work to join its ranks and coöperate in its activities. The dues are $2 per annum. Charts and full instructions for observing are furnished gratis.

The work is of scientific value, of fascinating interest, involves no mathematics and anyone with average intelligence can master its details. The secretary will be glad to furnish any further information regarding the subject.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

Geographical Blind-Man's Buff

To the Editor of the SCIENTIFIC AMERICAN:

I read with much amusement your recent plaint under the above title and want to say that I too have observed this curious tendency on the part of residents of the smallest and most insignificant regions of the earth to take more for granted that one who hails from a great metropolis. But your excellent presentation of the case does not really show the thing up in its ultimate degree of atrocity, and on this account I want to share with you a particularly horrible example which just comes to me.

I recently printed a summary of some work done by the United States Bureau of Standards. It would seem that any civilized white person of sound mind would have sufficient imagination to address the Bureau, if address it he must, in our capital city. But no, an official envelope comes to me from some portion of the British Empire—what portion I cannot tell for the simple reason that having no stamp to cancel, the postmaster has not troubled himself to hit the letter at all. Inside I find another and similar envelope addressed to the Director of the Bureau of Standards, and a polite letter asking me to forward it, since no address was given in the printed article. For my convenience in replying to the gentleman who asks this favor, I find in the upper left corner a serial number, with the typed request that future communications on the subject in hand be identified by reference to this number. Opposite this, in the upper right corner, I read "Dated the 18th December, 1919: from the Principal, King George's Medical College."

Yes, that is absolutely and literally all. This man, who cannot decide on his own initiative where to address the United States Bureau of Standards, sends his own letters abroad with no particulars as to where he himself may be reached other than that one line—King George's Medical College. Can you beat this one? I think you will agree that it goes considerably beyond the village storekeeper of San Juan, or even the calmly confident gentleman from Cocanada.

A BROTHER EDITOR.

New York.

Earth-Ripened Eggs

To the Editor of the SCIENTIFIC AMERICAN:

On page 314 of your March issue, in the article "Strange Things to Eat," mention is made of the use of "ripened eggs" by the Chinese. The statement is included therein that "the land of Cathay appears to be the only region of the globe given to maturing eggs by earth-preservation."

In some parts of the Philippine Islands the natives have eaten "earth-preserved eggs." Perhaps they adopted the habit from those Chinese who came to the islands a few centuries ago and whose descendants are now found in the western part of the largest island, Luzon. These descendants, of course, are now a mixed blood, as there has been much intermarrying with the natives.

On a trip up the Pasig River from Manila, I have seen the launch boarded at the important provincial city of Pasig by native peddlers with wares to sell. These wares included, among other things, eggs which had been preserved in the warm earth. They were regarded as a delicacy by the natives who purchased them. No cooking was apparently necessary or desired, one end of the shell being immediately broken open and the contents eaten in several bites. Some Americans in the party called the food chicken on the half-shell. HOMER J. CARLETON.

Los Angeles.

Why "Reclaim" It?

To the Editor of the SCIENTIFIC AMERICAN:

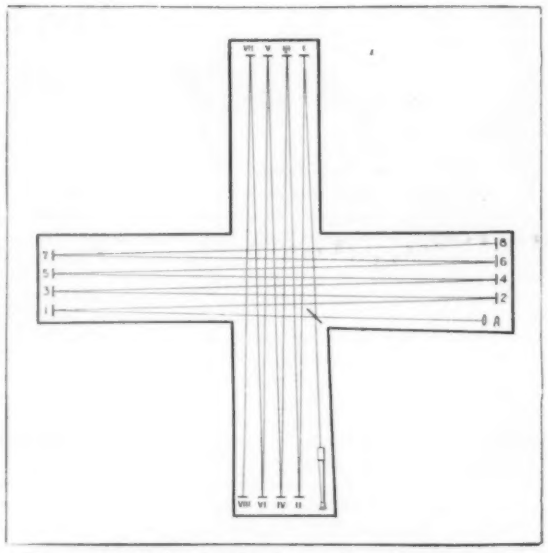
Reclaiming slate waste in Wales, from which a great variety of valuable products is derived, leads to an inquiry why some of the deposits of this section, for instance, might not be employed for the same purposes, all of them, and without the preliminary use of machinery for grinding.

One of the old and important industries of this county is the oilcloth business. For many years slate was quarried at some distance from the factories, loaded upon barges, and after several handlings ground and employed as a filler for the burlap upon which the colors were printed, at first by hand and then by machinery.

It was then found that clay, nothing more nor less than slate finely ground by nature herself, answered every purpose as a filler, and the laborious process of quarrying and grinding ceased. There is here upon a bedrock of slate a variety of clays, varying in color from light gray to deep indigo blue. Much of it, when wet, is as smooth and gritless as soap. Could not such material, properly dried and screened, be used for all the various products your article mentions, and great industries be established here as well as in Wales, where electric power also is available and transportation to the cities of the coast possible both by water and by rail? GEORGE S. PANIL.

Winslow, Me.

The ether-drift interferometer with which the Michelson-Morley experiments were repeated by Morley and Miller at Cleveland in 1904-06. It weighs 1900 pounds and gives an effective light-path of 224 feet, or 150 million wave-lengths



The path which is taken by the two branches of the light beam from the source at A, as split by the mirror, reunited and thrown into the telescope

Checking Up Einstein

The Proposed Repetition of the Michelson-Morley Experiment in Search of Evidence of Ether Drift

By M. A. Henry

PERHAPS the very experiment which started Einstein at work on his now famous "theory of relativity" will be the means of demonstrating to the scientific world the correctness or incorrectness of his conclusions. The classical experiment performed by Michelson in 1887 and repeated with better apparatus by Morley and Miller, to determine "ethereal drift," upon the assumption that the ether of space is a stationary sea through which our earth moves, is the experiment referred to.

New interest is aroused by the statement made recently by Prof. Dayton C. Miller, one of the original experimenters, that the work has never been carried far enough to be positive in its results. He has proposed moving the apparatus, which is still intact, to the top of Mount Wilson, near the famous Lick observatory and repeating the experiment there, with the coöperation of the Lick scientists.

Such an event would undoubtedly attract the attention of the entire scientific world for, although many scientists now recognize the probability that Einstein's theory will displace Newton's law of gravitation and indeed revolutionize our whole fundamental conception of the structure of matter and space, there are still many doubters. In addition, Einstein himself has said that his theory was built primarily as an explanation of the results of this experiment and if any appreciable ethereal drift can be noted in repeating it, it must be conceded that Einstein's theory will have to be abandoned. To quote Einstein:

"The great attraction of the theory is its logical consistency. If any deduction from it should prove untenable, it must be given up. A modification of it seems impossible without destruction of the whole."

If, on the other hand, it can be conclusively proven that there is no drift of ether past the earth, or through it (since the old conception of ether is that it pervades all matter) it must be admitted that Einstein's case is greatly strengthened if not actually proven.

The apparatus which it is proposed to use is pictured here. It utilizes the principles of the interferometer, invented by Michelson, by which it is possible to measure the length of a light wave.

The machine is of structural steel, weighing 1,900 pounds. It has two arms which form a Greek cross. Each arm is 14 feet in length. The whole apparatus is floated in a trough containing 800 pounds of mercury.

Four mirrors are arranged on the end of each arm, sixteen in all, with a seventeenth mirror, M, set at one of the inside corners of the cross, as diagrammed. A source of light (in this case a calcium flame) is provided, and its rays directed by a lens toward the mirror M. Part of the light is allowed to pass straight through M to the opposite arm of the cross, where it strikes the mirror 1. It is reflected back across the arm to mirror 2, thence to 3, and so on until it reaches mirror 8. Thence it is reflected back to mirror 7, to 6, and so on, retracting its former path and finally is caught by the reverse side of the mirror M and is sent to an observer at O. In retracing its path the light sets up an interference phenomenon and the interference bands are visible to the observer, who is provided with a telescope to magnify the results.

A second part of the original light beam is reflected off at right angles by the mirror M, and is passed to and fro on the adjacent arms of the machine, in exactly the same manner and over a similar path, by means of the mirrors I, II, III, . . . VIII. This light finally reaches the observer at the telescope, setting up a second set of interference bands, parallel to the first.

If it were possible for us to make the apparatus with such a degree of refinement that the path from mirror M via mirrors 1, 2, 3, etc., back through M and into the telescope, were exactly the same length as that from flame to telescope by way of the mirrors I, II, III, etc.—exactly the same to a margin of error materially less than a single wave-length of light—why, then, the two sets of interference fringes would come out exactly superposed provided the motion of the earth through the "ether" turn out to have no influence upon the velocity of light; and, if such influence exist, these fringes would be displaced from one another to an extent measuring the influence in question. But our ability to set up this complicated pattern of mirrors at predetermined distances falls far short of the wave-length as a measure of error. So in practice all that we can say is that having once set the instrument up, and passed a beam of light through it, there will be produced two sets of parallel interference fringes. These sets will fail of superposition—each fringe of one set will be removed from the corresponding fringe of the other set—by some definite distance. Then, any subsequent variation in the speed of light along the two arms will at once be detected by a shifting of the interference bands through a distance which we shall be able to measure.

Under the old theories of light, it will be readily seen that if this machine be set up in an "ether stream" with one arm parallel to the direction of the stream and the other at right angles thereto, there will be a difference in the speed of the light along the two arms. Then if the apparatus be shifted to a position oblique to the ether stream, the excess velocity of the light in the one arm would be diminished, and gradually come to zero at the 45-degree angle, after which the light traveling along the other arm would assume the greater speed. In making observations, therefore, the entire apparatus was slowly rotated, the observers walking with it, so that changes of the sort anticipated would be observed.

But the experiment was a failure—at least, its result was negative so that, to the workers who believed in the ether theory of light, it seemed a failure. Such small variations in the positions of the fringes as were noted were less than one-fortieth of what the preliminary calculations based upon the ether-wave theory of light had called for; and these were readily accounted for on the ground of defects in the apparatus and errors in observation. But reluctant to abandon the classical theories, the experimenters suggested that since the original apparatus was made of wood, perhaps the ether stream had the effect of compressing this material enough to compensate for an actual difference in light velocities. In a way, of course, this suggestion anticipated Einstein.

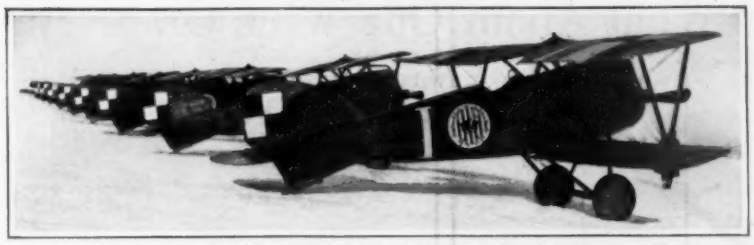
Professor Michelson made his studies while at Case School, and when he went to Chicago his successor, Professor Dayton C. Miller, carried forward the project. His collaborator in this was Prof. E. W.

(Continued on page 660)

EVERY attempt to put the fundamentals of the Einstein theory into language which the intelligent layman can grasp comes very shortly to a statement of the philosophical difficulties encountered in trying to set up a satisfactory set of properties for the ether which was pictured in the classical theory as filling all space. In the words of Dr. Slosson, it seemed necessary either that this ether should be carried along by the earth or that it should flow through the earth; but it obstinately refused to do either of these things! The Michelson-Morley experiment which demonstrated this, originally performed in 1887, attains honorable mention in the popular as well as the technical expositions of the Einstein theory, because its result was one of the puzzles which could not be positively accounted for under old systems, but which fall in absolutely with Dr. Einstein's views. It is always made plain, when this experiment is cited, that it has something to do with light, and that it is in fact an effort to detect a relative velocity between the ether, in which the light-waves are carried, and the earth, where they are received and recorded. But just how the experiment was set up, and precisely what apparatus was used, is seldom made clear. In view of the expectation that the experiment will be repeated at an early date, with every prospect of far greater accuracy than has ever before been attainable, Mr. Mount's careful description of the experiment and the equipment employed therein is of very immediate interest.—THE EDITOR.

Poland's Aerial Fighters

THE recent heavy fighting between the Polish forces and the Russian Bolsheviki lends interest to the accompanying photograph of the Kosciuszko Squadron, which forms a unit of the Polish air service. The Kosciuszko Squadron is composed of volunteer American fliers, commanded by Major Cedric E. Fauntleroy. The planes are of the latest single-seater fighter type, equipped with machine guns firing through the propeller sweep. The squadron has been cited in the recent fighting, and at least one of its members has been shot down behind the Bolsheviki lines. It may be that the record of this volunteer organization may be comparable to that of the glorious Lafayette Escadrille, which did such signal work for France before our entry into the world war.



The Kosciuszko Squadron of the Polish Army, which is manned by American fliers

Floating Houses of Berlin

IT seems, from all reports, that the housing problem is a universal one. From San Francisco to New York, in the United States, and from Lisbon to Stockholm, in Europe, people are suffering from the serious lack of housing accommodations.

Berlin, capital of Germany, is no exception to the present rule. Railroad coaches, former army barracks, old street cars, packing boxes—all sorts of improvisions are to be found serving as habitations of one sort or another. In the accompanying view there is the interesting case of a German who, finding nothing available on land, built himself a small cottage on a barge. He represents hundreds of other Berliners. His cottage is beautified by attractive flower boxes and vines.

One of Berlin's numerous house boats which are serving to solve the housing problem

Boulder Billboards of China

WHAT China lacks in mechanical progress she more than makes up in a glorious history and a great civilization that dates back to many centuries before the dawn of Occidental history. Indeed, China today is a treasure house of invaluable antiquities, one more marvelous than the other.

We have the accompanying illustration to add to the many others that have appeared in these columns from time to time. Here are the great Rocks of Amoy, which are famous the world over. These rocks, or boulders, are countless centuries old, and on their faces they carry vertical columns of Chinese inscription carved into the rock. These inscriptions were made by the ancient Chinese and are of a historic nature. The fishermen's boats, drawn up the beach in front of the center boulder, give some idea of the size of the rocks.

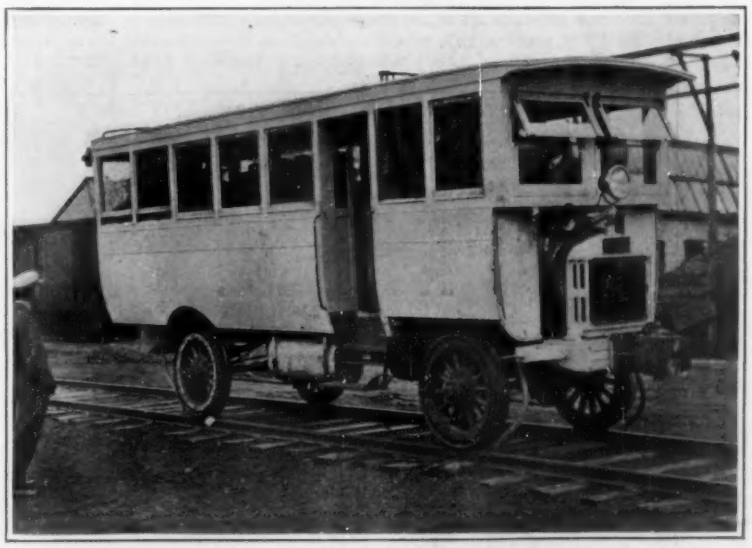
Copyright, Keystone View Co.

One of the Rocks of Amoy, China, with fishermen's boats drawn up in front on the beach

When the Motor Truck Becomes an Interurban Car

THE rising cost of material and labor has played right into the hands of the modern motor truck. In truth, despite the steadily rising cost of gasoline, the motor truck today is in a position to compete with railroads, interurban cars and street lines as a carrier of goods and passengers. The reason is simple, although not obvious to the layman at first glance. It is due to the greater amount of labor and material in the case of other carriers that the motor truck today is a formidable competitor in many fields of transportation.

There is a growing tendency to use motor trucks with flanged wheels for passenger and freight service on the branch lines of many railroads. The operation of a steam train, with its crew of engineer, fireman, conductor and brakeman, is highly expensive, especially where the volume of traffic is insufficient to warrant a train of reasonable length. And it is in numerous cases of this kind that the branch line and small railroads are turning to motor trucks for relief from the high operating costs.



One of the several motor trucks now being used on a small railroad in order to reduce operating costs

The accompanying illustration shows one of the motor trucks now serving on a small railroad known as the Lake Zurich and Wauconda, in Illinois. The truck is of three-ton capacity and has a four-wheel drive. It carries 30 passengers in comfort and hauls a five-ton tailer loaded with freight. Standard railroad couplers, flanged rims and sand boxes are used. It is reported that the truck makes the 32-mile run of this railroad on six gallons of gasoline with full load.

Effect of Peace on Patents and Trademarks

DURING the period of the war numerous patents have gone void in the countries of the high contracting parties through the non-payment of fees, or non-working, or non-fulfilment of various formalities. All these can be revived within one year of the treaty coming into force on payment of the regular fees due in the interim, and without extra fines or payment, but always without prejudice to the rights of third parties acquired in the meantime. Any patent which could have been filed during the war to claim rights under the International Convention, but which for any reason whatsoever was not so filed, can now be filed during the six months after the treaty coming into force, but again without prejudice to the rights of third parties acquired in the meantime, so that apparently any person having got to work on such defaulted patent during the interim can continue to infringe even though the patent be renewed to the original inventor.

In Continental European countries these patents will date from the day of application in those countries, but with priority date as of the date of the original application in the country of origin. In the United States and Canada they will date from the day of grant of the application after allowance, while in Great Britain, Australia, New Zealand and South Africa, they will date from the day of application in the country of origin, unless a new legislation changes this.

Each of the Allied Associated Powers reserves to itself the right of imposing such limitations, conditions or restrictions on rights thus granted (except in the case of trade marks), or which may subsequently be acquired, in accordance with its legislation, by German Nationalists, "whether by granting licenses or by the working, or by preserving control over their exploitation, or in any other way as may be considered necessary for national defence or in the public interest, or for assuring the fair treatment by Germany of the rights of industrial and literary property held in German territory by its Nationalists, or for securing the due fulfilment of all the obligations undertaken by Germany in the present Treaty, but the rights thus reserved by the Allied and Associated Powers shall only be exercised in cases considered necessary for national defence of the public interest." The provisions of this article shall not apply in the case of businesses or companies liquidated under war legislation by the Allied or Associated Powers.

From this it would appear that even those patents which have been deliberately allowed to go void by their owners during the war can now be resuscitated for the remainder of the period of grant. This at first may seem unfair, but on the other hand it would be still more unfair to natives of a country if foreigners could renew their rights while they themselves could not.

The treaty is reciprocal as regards patents and trade marks with the exception above stated, and we are able now to obtain patents and pay the fees on them in the enemy countries.

What About Our Wine Grapes?

A Few Reasons Why Prohibition Is Not Going to Bankrupt the California Growers

By Arthur L. Dahl

CALIFORNIA fruit growers have been so accustomed to finding markets in all parts of the United States, and abroad, for their products that adverse conditions affecting the industry in one locality did not loom up disastrously, as other markets could be developed. But the advent of prohibition swept away as by a tornado the entire commercial market for wine grapes for the making of wine, and the growers of the West must build up a new market for their future crops without the old pattern to go by.

Will the wine-grape industry survive? The farther away we get from the "wet" period, the brighter seems the prospect for the continued prosperity of this industry, for new methods of utilizing the grapes are being worked out constantly.

When the storm clouds of prohibition were slowly gathering over our land, there were many who doomed the vineyards to destruction, for they thought that wine grapes were good for one and only one thing, and that the making of wine. Close the wineries, said they, and the wine grapes would have to rot on the vines for there would be no other way to utilize them.

Drying wine grapes in California by means of the sun

That there are many other ways of utilizing wine grapes is shown by the range of prices offered growers for their 1920 production. These prices are, in many instances, as high as the top prices paid for grapes in the sunniest days of the "wet" regime. Grapes are being bought today for drying, for the making of table syrup, for pressing into soft beverages and for the making of vinegar.

During 1918 and 1919 vast quantities of wine grapes grown in California were dried in the sun, following the process used for the making of raisins, and the dried product then shipped to various parts of the Unite States and Canada for the making of wine in the home. This was not a new thing, for during the phylloxera crisis in France, millions of gallons of wine were made from dried grapes imported from Turkey and Greece, and while not equal to the wine made from the freshly pressed grapes, the wine made from the dried product proved very acceptable to the wine-loving people of France.

A ton of fresh grapes with 23 per cent of sugar will yield about 550 pounds of dried grapes. If this quantity is fermented with 180 gallons of water it will produce 180 gallons of wine with an alcoholic content of about 11 per cent.

Many individual growers are planning to dry all their wine grapes this year and dispose of them as raisins for cooking purposes. It has been found that dried wine grapes, when made into pies or puddings, possess a distinctive flavor that is very pleasant. This flavor so closely resembles blackberries that the new product is expected to become very popular with restaurants, bakers and other large consumers of pie fruits.

What promises to prove an extensive market for fresh grapes is the new grape syrup industry that is being vigorously pushed by many different concerns on the Pacific Coast. Grape syrup has been made for a long time, but practically all the product was utilized in sweetening and fortifying wines, and no effort was made to get out a superior quality for use as a table syrup.

Under a new process, invented by Mihran K. Serailian, long identified with Luther Burbank, it is now possible to produce a grape syrup that retains all of the distinctive flavor and aroma of the grape, and when used as a table syrup it proves most delightful. On hot cakes, muffins and other breakfast foods, the new syrup is expected to compete successfully with maple and other high-class syrups, and the new product is also said to have an advantage in that it will provide a very appetizing and delightful drink when diluted with water. So successfully does the Serailian process preserve all of the delicate bouquet of the grape, that the grape syrup, when made into a drink is said to possess all of the qualities of the vanished wine with the possible exception of the "kick."

Since many of the processes involved in the making of grape syrup are similar to those used in wine making, it has been found possible to utilize a good deal of the equipment already installed in the wineries.

Grapes, even if carefully handled, will keep in good condition at most for only a few days. The juice, however, carefully handled, will commence to ferment in a few hours after extraction. Most vineyards are so situated that the grapes can be brought in good condition to the winery, but once there they must be crushed quickly or they will spoil. As soon as the juice is extracted it must be made into syrup or preserved in some way. As the vintage in any one locality lasts only four or five weeks, the problem on which the grape growers are now working is to devise some means for keeping the pressed juice until it can be made into syrup. A number of the viticultural scientists of the Department of Agriculture and of the University of California, are working on the problem, and already some very successful results have been obtained in the use of a sulfurous acid preservative that is harmless and does not affect the flavor of the juice.

As grapes contain a high percentage of sugar, they lend themselves admirably to syrup making. The riper the grapes the more sugar they contain and the more sugar they will yield. Cull table grapes at the beginning of the season may show a sugar content as low as 15 per cent, but wine grapes are usually gathered when they show 22 per cent to 23 per cent, and often as high as 27 per cent. One hundred gallons of juice at 23 degrees Balling contains close to 190 pounds of grape sugar; at 19 degrees Balling, only about 157 pounds; but at 27 degrees Balling, about 223 pounds.

The volume of one ton of stemmed grapes at 23 degree Balling is 29 cubic feet or 219 gallons. This consists of skins, seeds, and juice in varying proportions. The average volume of juice actually present may be taken as about 190 gallons, but it will vary from 175 to 210, according to the variety and the development of the berry. Wineries, by crushing and pressing can separate more or less of this juice from the solids of the grapes. The average volume of juice extracted in this way from unfermented grapes will not much exceed 150 gallons per ton. The remainder, about one-fifth of the whole, is retained by the pomace, or solid matter.

An enormous amount of neutral syrup is used in the canning industry, and tests have been made to determine the advisability of using grape syrup with canned fruit. Certain fruits, such as loganberries, black cherries, and some peaches were as good when canned with grape syrup as with sugar. Apricots were improved in color but the flavor was less fresh. Pears were darkened somewhat but the flavor was good. By mixing grape syrup with the ordinary sugar syrup splendid results were obtained, and it is expected that a considerable market can be created for grape syrup in connection with the canning industry.

Another prospective market for wine grapes is in the manufacture of grape juice. Up to the present time the western grape has not made a very satisfactory juice for beverage and the market for this drink has been virtually monopolized by the eastern Concord grape. That the California grape will produce a very high quality of grape juice was shown at the

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MANY are the readjustments which the coming of prohibition has brought to the industrial and commercial world. Perhaps the most serious problem, as well as the one which has received most attention in the press, has been that of the ultimate fate of the breweries, with their buildings and machine equipment representing an investment of $700,000,000 or more. But the manufacturers were not the only ones who had to find a new field of operations. The plight of a middle-aged person with flat feet and soft hands who knows how to do nothing except serve drinks and who is barred by legislative enactment from this occupation furnishes ample material for humor or tragedy, according to the resourcefulness of the individual. Even more hopelessly involved than the bartender, however, seem to be those who have been engaged in the growing of the various crops from which have been manufactured the beverages that are now taboo. The raw materials employed in the making of distilled, malt and vinous liquors in 1909 were valued respectively at 37, 96½ and 6½ millions of dollars. Obviously these "raw materials" are almost entirely agricultural products like hops, barley, corn, rye, grapes, etc. It might well seem at first glance hopeless to seek new markets for this bulk of croppage. But as far as the grapes are concerned—doubtless one of the smallest items in question but nevertheless large enough to count, and significant of the way the wind blows—as far as the grapes are concerned—Mr. Dahl tells us in this article that the problem is solved, and then some.—THE EDITOR.

Picking wine grapes in California, but for what purpose?

Directing the Detourist

By Avis Gordon Vestal

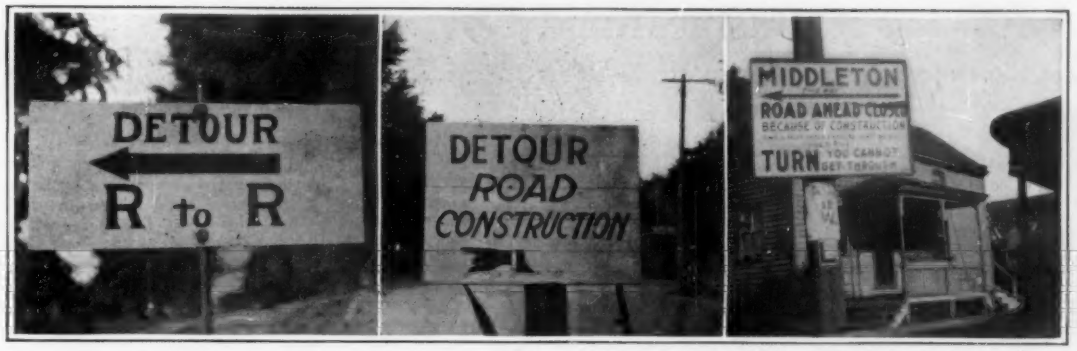
THE year 1920 promises to be a banner one in the life of the good roads movement. In addition to roads whose guardians will just awake to the fact that they are living in the era of paved highways, there will be much repair work undertaken which was postponed from 1917, 1918 and 1919 on account of high prices and war-time conditions. Finally, in many parts of the east the extraordinarily icy winter has played great havoc with the roads, and made it necessary for road-work to be done which would not normally have been called for. So the coming summer promises to be well filled with annoying barriers blocking the motorist off of stretches of road torn up for reconstruction. And this brings up the question of the detour sign. Shall the motorist be told where the roads are out of commission and where to turn to avoid the dead stretches, or shall these things be kept a dark secret from him until he finds out by the painful process of getting stuck in it that a given pieces of road is not passable? It all depends upon the sign.

Of course there are two sides of this, as of most questions. There is the detour that is left absolutely unmarked, so that the most conscientious driver in the world has no way of knowing that he must drive over the mountain through Little Village instead of taking the main road down the valley. But there is also the man who will submit to death by slow torture before he will detour. In the face of a detour sign that occupies the entire landscape he will either argue that the mouth of the forbidden road looks pretty good and that he doesn't believe it is bad enough to make the detour worth while, or insist that his particular car is equal to the worst-torn-up road this side of the habitat of asbestos puppies and that he is going through or know the reason why.

For this type of tourist the road menders can do little more than they have done in one of the signs which we illustrate. After arguing with him, and explaining to him, and cajoling him, and threatening him, the Road Commission has surely done its duty, and can leave him to his fate with a clear conscience. If he insists on driving ahead into an impenetrable jungle of stones and mud, his fate is on his own head.

For the more reasonable variety of automobilist the main point of the detour sign is that it should be conspicuous enough for him to see it, and that it should give him the information that he wants. Under many circumstances the plain pointer of one sort or another shown in our second and third views is quite sufficient. When the path into which the sign directs the tourist rejoins the main line without possibility of straying off into uncharted bypaths, there is no need to do more than tell him in unmistakable language to take it. Where the case is not quite so simple, it is desirable—but unfortunately not everywhere customary—to give enough directions so that he may be reasonably certain of getting safely back upon the main line.

To give credit where credit is due I thumb the leaves of my motor "log books" and find that first rank goes to a plain placard posted on the River-to-River Road in Iowa. The traveler need harbor no distressing indecision for the arrow is unmistakable. The second notice, "Detour, Road Construction," the kodak memorialized on the Lincoln Highway at Cedar Rapids, Iowa. And other eminently satisfactory detour markings of the same general nature as these might be instanced.



Left: A 1919 detour sign on the River-to-River Road in Iowa. *Center:* On Lincoln Highway in Cedar Rapids, Iowa. *Right:* The middle of the three signs, with the triangle, is a standard detour sign used temporarily when detours are necessary from the 5,000 miles of Wisconsin State Trunk Highways. The upper, large placard was a special one. Photographed in Madison, Wisconsin.

Some detour signs which greet the mid-west automobilist

When we motored into Wisconsin we first met a real and responsible system for aiding and abetting temporary travel while accustomed routes are receiving first aid to the injured. In my article in the SCIENTIFIC AMERICAN of Jan. 24, 1920, I mentioned briefly the preparation of paper detour signs for use when any portion of the 5,000 miles of the State Trunk Highway System should be closed for construction or reconstruction. The exhibit, then, illustrates that point. Below the standard detour sign you will notice the symbol for a turn to the left, while above is a huge sign board, an "extra" that was added because of a special circumstance explained courteously: "Open a short

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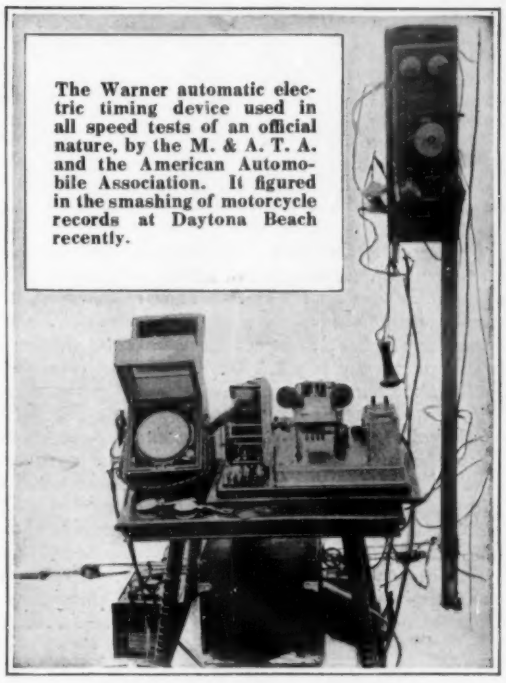


The Warner automatic electric timing device used in all speed tests of an official nature, by the M. & A. T. A. and the American Automobile Association. It figured in the smashing of motorcycle records at Daytona Beach recently.

Breaking the World's Motorcycle Records

By Ralph Howard

ALL existing professional and amateur solo records for the kilometer, mile, two miles and five miles were completely annihilated recently at Daytona Beach, Fla., when Gene Walker and Herbert McBride drove their motorcycles over the sand. Walker covered the kilometer in 19.32 seconds, or at the rate of 115.79 miles per hour. His time for the mile was 31.53 seconds, or at the rate of 114.17 miles per hour. His two-mile record was made in 1:04.45 or at the rate of 111.17 miles per hour and the five miles in 2:45.62 or at the rate of 108.71 miles per hour.

Herbert McBride, the amateur, covered the kilometer in 21.43 or at the rate of 104.40 miles per hour. He covered the mile in 34.63 or at 103.95 miles per hour; the two miles in 1:11.19 or at 101.13 miles per hour, and the five miles in 2:59.67, or at the rate of 100.18 miles per hour. Both Walker and McBride rode 61-cubic-inch eight-valve motorcycles of well-known make.

Gene's performance with his 61-cubic-inch twin-cylinder engine was 3.81 miles faster than the fastest previous kilometer, 3.23 miles per hour faster than the fastest previous mile, 2.32 miles per hour better than the fastest previous two miles and nearly one mile per hour faster than the best previous five miles. Walker and McBride rode the same course as that used for a former set of records, timed by the same accurate and efficient apparatus and with distances accurately surveyed. The previous fastest times were made with a 68 cubic inch motor.

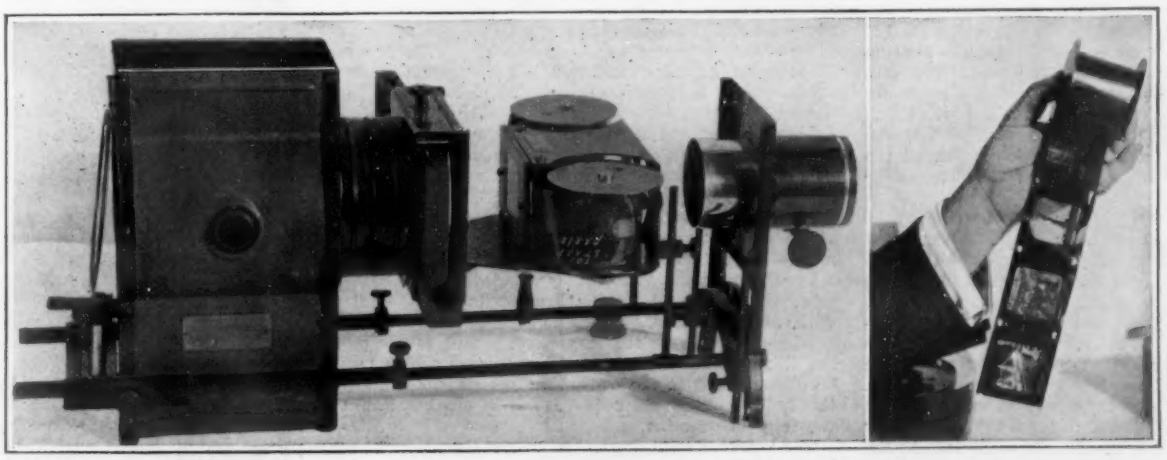
For timing these motorcycle records, the Warner automatic electric timing device, which is the official apparatus of the M. & A. T. A. and the American Automobile Association speed tests, was employed. So startling was the first test with the motorcycles that the feat was repeated in order to make certain that everything was accurate, and that the timing apparatus was in unquestionable good order.

Lantern Slides by the Yard

MANY attempts have been made to secure greater portability for the stereopticon outfit of the itinerant lecturer, but practically all of these have had to do with the lantern and not with the slides. The latter have remained much the same—glass slides which weigh a great deal and take up much room in the traveler's limited baggage, not to mention their huge cost.

It has remained for one of the large American photographic companies to develop a new system of stereopticon projection. Instead of the bulky glass slides, this new system makes use of roll film. Thus a film containing 100 views weighs but eight ounces, and its carton twelve ounces, making a total of twenty ounces. The 100-slide glass set weighs twenty pounds in its carrying case. So it is immediately obvious that a great saving in weight and space is obtained with the new system, to say nothing of the immense reduction in cost.

The new system can be readily applied to the usual stereopticon equipment, as shown in one of the accompanying views. The spool holder, frame, picture-shifting lever and so on are combined in a unit which is placed between the condenser and the lens. The views are changed by pulling the lever, which causes a certain length of film to travel from one spool to the other, stopping when the next view is in the lantern's eye.



Stereopticon outfit arranged to take the new film shown at the right, reducing weight, space occupied, and cost

Business and Government

What the Department of Commerce is Doing for America and What It Would Like to Do

By Joshua W. Alexander, Secretary of Commerce

THE Government of the United States is divided into three parts—legislative, executive and judicial. The Department of Commerce was created in order that the affairs of the business men of the country might have full consideration by the executive side of the Government. The business men of the country, along with all other citizens, have their representatives in Congress. By making free use of the representation in Congress they can give their ideas and wishes expression. They thus have a voice in the legislative department of the Republic in proportion to the use they make of their representatives in Congress.

In like manner, in the executive side of this Government, the usefulness of the Department of Commerce to the business man is in direct proportion to the use that the business man makes of the department. The Department of Commerce, with its secretary, a member of the President's cabinet, is not an abstraction to serve in an abstract way the promotion of the commerce of the United States, but is a concrete and practical organization to attend to the wants and requirements of those who carry on the commerce of the United States, and to help them solve their commercial problems at home and abroad. This is only practically possible if they freely come to the department with their problems.

The Department of Commerce is maintained by appropriations by Congress. Every citizen's estimation of the value of the Department of Commerce and the extent to which it may serve his purposes is reflected in the attitude he takes in presenting his wishes to Congress. I feel that the Department of Commerce can be a great factor in increasing the production of the United States, provided it is furnished with the proper machinery and funds. We are passing through a period in which the most rigid economy is necessary. Greater efficiency—that is, greater results for the amount of energy and material resources expended—is more necessary now than at any period in our history. But what is economy? The greatest national economy is to facilitate the production of greater wealth. That is what gives the name of economics or national economy to the study of the production and distribution of wealth. The Department of Commerce differs in large measure from many of the departments of the Government in that it is not purely administrative, executing the laws of Congress, but is devoted almost entirely to the increase in the production of the national wealth through the encouragement and betterment of industry and commerce. Money appropriated for the Department of Agriculture, for instance, to make two ears of corn grow where one ear of corn grew before, results in a net gain to the wealth and production of the country many times the original expenditure. Likewise, if the Department of Commerce makes one spindle produce what two spindles produced before, makes one day of labor produce what it took two days of labor to produce before, the comparatively small appropriations that are necessary to carry on the scientific work that brought about this increased production will "bring forth good fruit" some forty, some sixty, some a hundred fold. Is it economy to save a few hundred thousand dollars in the appropriations for the Department of Commerce when this so-called saving will cripple the scientific and trade-promotion work that increases the production of the country by many millions of dollars?

THE Department of Commerce is peculiarly the business man's branch of the Government. It is organized with the single intent of expediting and benefitting American business. It is equipped to give extraordinary service in many directions. But like all other service, the service that it gives costs money; and this year Congress shudders at the mention of money, —unless a large number of very tangible votes be mentioned in the same breath. So the Department of Commerce faces, with other Departments, the necessity for curtailing its operations to keep within curtailed funds. At a recent convention of the Chamber of Commerce of the United States, Secretary Alexander described this situation to the business men there gathered, and explained why, in his view, his Department was one which should be supplied with funds sufficient for operation on a liberal scale. To save a couple of million dollars in running expenses of the Government at the expense of untold millions in business and national prosperity is indeed very poor economy. And in his remarks abstracted here, Mr. Alexander makes it very clear why the operations of the Department of Commerce cannot be curtailed without very serious loss to the country at large.—THE EDITOR.

Service of the Bureau of Standards

The first case in point is the case of the Bureau of Standards. I would state that the Bureau of Standards serves the Government and the public, giving aid and advice on the following matters:

This country is endeavoring to build up the scientific-instrument-making industry. Scientific apparatus of all kinds and many of the materials from which they are constructed have heretofore been imported. During the war many such industries sprang up which should by no means be allowed to lapse into the former condition of things. Furthermore, nearly all industrial processes now depend upon scientific methods of measurement and demand measuring instruments in all fields of measurement. The demands upon the Bureau of Standards for the calibration and testing of such measuring instruments have increased enormously in the past four or five years. The facilities of the Bureau of Standards are absolutely essential in work of this kind, since it is one of the most important factors in commerce and manufacturing, as well as all branches of scientific investigation. The facilities of the Bureau are entirely inadequate at present, and the coming year will find its resources much reduced.

The method of making purchases by competitive bids is absolutely necessary in public work of all kinds; but it is the worst method that could be employed if suitable specifications, methods of testing, and testing facilities are not available. All departments of the Government are united as never before in their efforts to place Government purchases upon a fair and businesslike basis. Furthermore, it frequently occurs that business corporations and the public generally come to the Bureau of Standards for information regarding specifications and methods of testing. The value of this information given to the public is even greater than the actual saving to the Government by assisting it in its purchases. The Bureau of Standards has assisted the various departments of the Government in preparing specifications, developing methods of testing, and has served as a testing laboratory for the various bureaus in many ways. As such, its facilities have not kept pace with the demands, and the curtailment of the Bureau's resources for such work during the coming year will have a very serious effect upon Government purchases.

Scientific and Industrial Research

The industries are realizing as never before the advantage of scientific methods and the value of scientific investigations. This has been greatly emphasized during the past five or six years. The new conditions under which the industries are being placed during this period have necessitated the adoption of many new materials, the modification of methods of manufacture, and even the establishment of new industries. The bureau has coöperated with the industries in many of the more important cases, and the value of this work alone would warrant the expenditure of the entire cost of maintenance of the bureau from its beginning. The bureau's own work depends for its quality upon scientific research of the highest order, and it has become, to a large extent, a scientific-research laboratory in physics and chemistry for the Government service. This not only increases the efficiency of Government work but often results in great economy.

For the present year an appropriation of $300,000 was provided for industrial research in coöperation with the industries. No fund ever appropriated for the bureau has resulted in greater benefit to the public. Many problems are now in progress which must be discontinued at the end of the present year, due to the failure of Congress to provide a continuation of the fund in question.

The bureau's total appropriation for the present year is $1,892,260. Realizing the great importance of the work of the Bureau of Standards in the development of the country's resources, the promotion of its commerce, and its importance to the industries, the Secretary of Commerce submitted estimates for the increase of the bureau's available funds to $3,246,440 for the coming year. However, the amount that will be available during the coming year is $1,219,360 if the pending bill providing for the general expenses becomes a law.

This action is, of course, due to the desire of Congress to reduce the public expenditures—a most serious matter at the present time. However, failure to provide adequate funds for the Bureau of Standards will, in many cases, have the opposite effect and result in greater expenditures in other places. There was no opposition whatever on the part of the appropriations committees to the work of the Bureau of Standards. On the other hand, the members have shown the greatest interest in the bureau's work, and the attitude of Congress generally toward the bureau has been appreciative and liberal.

The Bureau of Foreign and Domestic Commerce

Likewise the Bureau of Foreign and Domestic Commerce has proven itself to be a factor for greater production and efficiency in our export trade. Its efforts result in two ships sailing from American ports where one ship sailed before. We have long since passed the stage in economic development in which our exports, if there are to be any, consist of those raw materials and products of the mine and soil that sell themselves because other nations must have them in order to feed their industrial workers and to give them the raw materials for their labor. The time has come in the economic development of the United States when we ourselves must manufacture our raw materials and bring raw materials from abroad in order to keep the wheels of our industries turning and the dinner pails of our working people full. There is some question about the advisability of the exportation of raw materials unless we can produce a surplus. But the two or three great manufacturing nations of the world have demonstrated for two generations that the exports of the products of industry bring prosperity to the enterprise and to the labor engaged in industry, banking, and shipping.

The Bureau of Foreign and Domestic Commerce has helped to increase the wealth of the country through its foreign commercial service far beyond the relatively small funds appropriated year by year to carry on its work. Every member of the much overworked staff of that bureau appreciates deeply the splendid vote of confidence expressed by the business men through their representatives in Congress when the House, by a vote of 210 to 39, restored the items for commercial attaches and trade commissioners and the service of the Far East. But although permitted to continue this service for another year, the appropriations are not half enough to do what should be done. Never in the history of the United States has it been so necessary for the business men of the country to receive almost instant advice of momentous changes taking place from day to day throughout the world in which their business and their credit is involved. There should be an extension of the attache service and a strengthening of the attache offices, as well as an increase in the investigations by special experts.

More special experts are necessary in Washington to follow such phases of commerce, both domestic and foreign, as transportation, port development, finance, commercial disputes, legal advice, tariffs, etc. To the business men in search of information Washington is a confusing labyrinth of officialdom. To find one's way through this labyrinth requires not only a knowledge of the subject matter under consideration, but also considerable knowledge of the ins and outs of the various organizations of the Federal Government and the responsible person to consult within these departments and bureaus concerning one or the other phase of a question. If one could count the

(Continued on page 661)

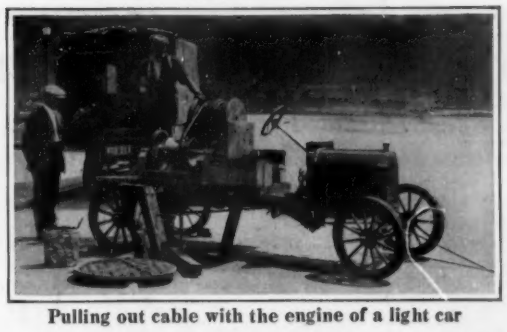
Artificial Fertilization of Flowers

By Jacques Boyer

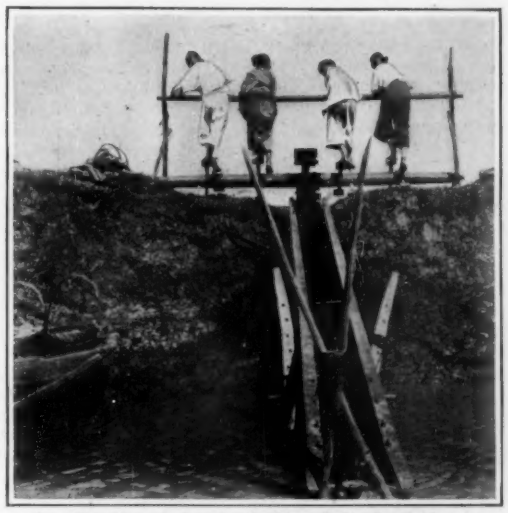
TO produce handsome flowers, attractive ornamental plants, or good vegetables, it is necessary first of all to get good seed and to plant these and care for them properly. Much can be done by careful attention to the details dictated by common sense; but when it comes to producing, for the first time, from seedlings, a variety which one has never before dealt with, the amateur and the florist alike ought to enlist the coöperation of a specialist. France holds first rank among the countries for the development of methods for the improvement of seedlings, for progress in artificial fertilization of seeds, and for the fixation of new species; before the war she exported 15 million seedlings per year. The chief reason for this is her realization that nature cannot be trusted to mate the best with the best, but that this must be taken in hand as much by the florist as by the animal breeder.

For each sort of seed the horticulturist chooses for reproductive purposes those free from every blemish. Now it often requires much time to fix a variety and to recognize in the seedlings the dominant characteristics which identify this variety. As soon as the plants have flowered, it is necessary to isolate the specimens showing the marks of the desired type. This is done by means of a light gauze net covering the flowers in question, and preventing insects and other agents from carrying out the processes of natural fertilization. Then the seeds are gathered, the subjects for the creation of the new generation are carefully selected, and at length, after several years, one will have succeeded in producing a pure race. The female plants require at all times a very special degree of attention. It is necessary often to reject nine-tenths of the offspring, if one is to have a pure and fixed race. Fortunately the reproductive factor attained through large-scale cultivation is always at least ten to one, and sometimes exceeds a thousand to one.

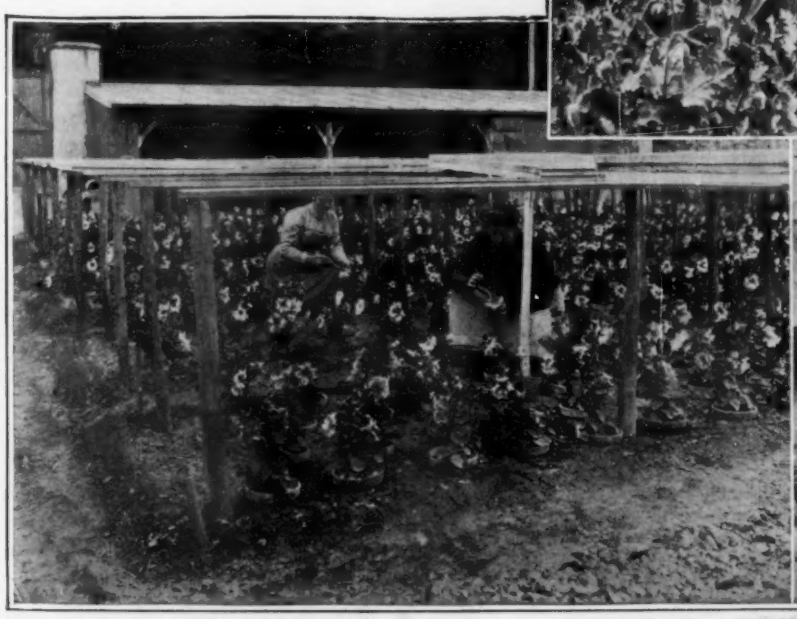
Ordinarily the large seed merchants make contracts with the specialist cultivators to whom they furnish seed, and whose cultural operations their inspectors scrutinize several times a year. For seed-beds in the open, it is necessary to see that all the necessary soil-treatment has been given; for those in frames, that they are properly exposed at the appropriate hours: for those in greenhouses, that the proper conditions of temperature, etc., are maintained. Of novelties that have not yet been seeded it is essential that the cutting of slips be conducted, and conducted properly. This is especially the case with century plants, nasturtiums, pinks and chrysanthemums, of which it is the constant endeavor to produce new varieties. And then there are always being produced curious hybrids by means of artificial fertilizing. As our photographs show, this operation consists in elevating the anthers of the flower to be fertilized, then in depositing upon these the pollen of the fertilizing variety. Such artificial reinforcement of nature's processes is practised, for instance, to create superb specimens of roses, amaryllis, orchids and other beautiful plants, which are so greatly admired at the flower shows.

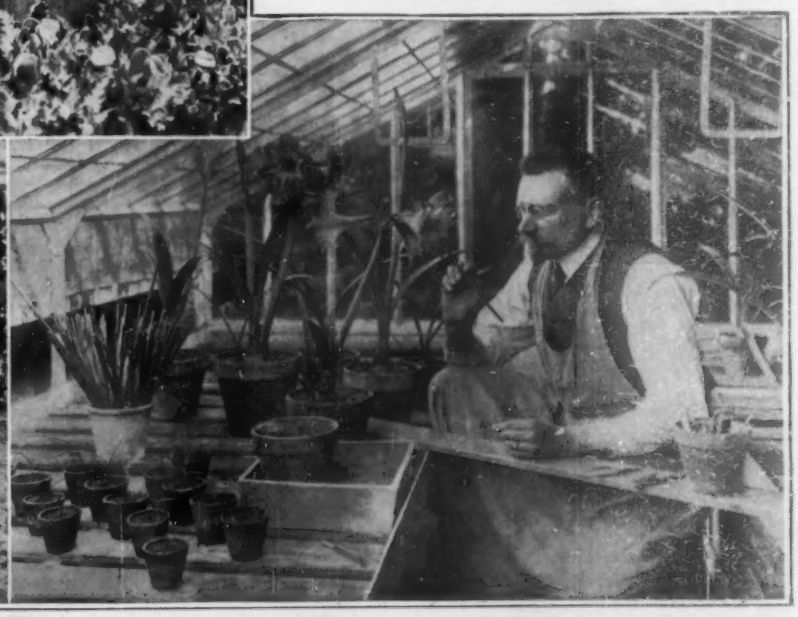


Pulling out cable with the engine of a light car



Combination of the treadmill and the fixed bicycle employed in Chinese irrigation





Above: Spreading a gauze net over a group of blossoms that are to be fertilized by hand, so as to prevent nature from forestalling the florist. *Left:* Fertilizing petunias by hand. *Right:* Placing the desired pollen upon the anthers of the amaryllis.

How the French gardeners fertilize flowers artificially to secure the varieties which they seek

Pulling Cables by Auto-Power

AMONG the many general-utility jobs to the credit of the automobile engine must now be listed the pulling of cables out of conduits, as practised by the illuminating company of Buffalo. The cable-pulling winch is belted to the drive-shaft of the car by a two-inch chain. By using the change-speed gears, the reverse, and the brake, with the rear wheels of the car jacked off the pavement, the pulling device is under complete control at all times. An inch of cable can be pulled, or many feet, as conditions dictate. It is stated that about 50,000 feet of cable have been pulled from the conduits in and around Buffalo by this ingenious device, invented by William Hemphill, an employe of the company. When big jobs are under way, it is found feasible to remove the differential connection or otherwise make the wheels of the car permanently free of the engine, so that the cable-pulling car can be towed about and hitched to the cable without the necessity for jacking it up. That the small car supplies ample power for this work is evidenced by the fact that in twelve minutes it pulled a section of heavy cable that, without its aid, would have kept ten men with a hand-winch busy for four hours.—By *K. H. Hamilton.*

The Treadmill in Irrigation

WE illustrate herewith a primitive Chinese pumping station for elevating water to a level from which it can be distributed over the fields. The apparatus is of interest from at least two viewpoints. The immediate task of carrying the water up is performed by what really amounts, in general principle, to a chain belt of buckets. The motive power is of course that cheapest of all things in China—human muscle. Perhaps it were better to say in this instance that it is human weight, since actual muscle appears to have little to do with it. The arrangement of the treadmill is itself rather unique—indeed, to a certain extent its designer appears to have anticipated the bicycle. He has grouped a series of pedals about a shaft, sufficiently close together angularly so that the operator can step from one to the next without losing any great vertical moment upon the shaft. With four sets of sprockets of this sort, and four operators to do the treadmill act by walking around the shaft as they balance themselves on the hand rail, a very respectable amount of power is developed. The difficulties of starting are minimized, it would appear, by the fact that the water-carrying portion of the mechanism is under no load to speak of until the shaft has made a revolution or two.—By *A. R. Surface.*

A Guide to American Grasses

THE U. S. Bureau of Plant Industry has just published in the form of an octavo volume of more than 300 pages a valuable manual by A. S. Hitchcock on "The Genera of Grasses of the United States, with Special Reference to the Economic Species." This work, which is copiously illustrated with photographs and excellent drawings, treats especially of the species of grasses that are either useful or harmful, including introduced and cultivated species.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A yank of the crank—and the fence is tight

Tightening the Fence with a Twist

FENCES on right-of-ways can now be kept in first class condition indefinitely by the invention and use of a new tightening device which makes use of a post with a ratchet and special open-end wrench for tightening. A few turns will make it as tight as desired.

The posts are made of either iron or concrete. The iron one is usually made of a large sized metal pipe standard, which is supported by a triangular metal plate. To this plate are securely fastened the ends of a triangular bar of metal. The triangular bar represents the supporting base of the entire equipment. To the other corners of this supporting structure are secured the two reinforcing rods as illustrated. Any slack which may occur during the year can be taken up immediately by the ratchet arrangement on the supporting base.

Airplane Styles in Automobile Cooling Fans

AN ingenious device for more efficient cooling of automotive engines is being placed on the market by a Chicago concern. This device takes the place of the fan as used in a motor car in which it may be installed, and serves to distribute air currents over the entire motor surface. Instead of having a diffusion of air striking the first cylinder and then be thrown off the ends of the blades, there is a concentrated shaft of swiftly moving cool air which is just wide enough completely to cover the surface of the motor. Less power is needed to operate this type of fan, it is claimed, than the old four- or six-blade type.

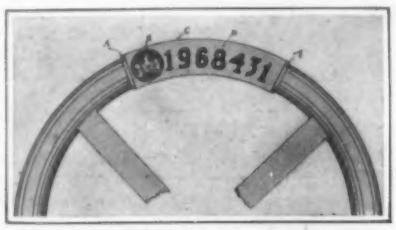
The two blades are in one piece, providing at the hub a cone-shaped cap protecting the bearings against dust and dirt. The blades are also instantly detachable from the hub and the hub is readily opened to replace bushings.

Broken-away view of automobile radiator, showing propeller-type fan

Would a State Seal and Number Prevent Motor Car Thefts?

FRANK WENZEL of Albany, N. Y., chief of the State's automobile bureau, located in that city, has invented and patented a catch-thief device as a means of protecting automobiles from being stolen. The device is attached to the steering wheel and consists of a two-part metal shell, clamped around the rim of the wheel. The motor number of the registered vehicle, as well as the State seal, is imbedded in a hard wax-like element molded between the shoulders of this metal shell. On the lower side is to be imbedded the key number corresponding to the index of files in the State registration bureau.

The mandatory application of the device would serve to eliminate theft by making it impossible for the thief to dispose of the car by his inability to secure registration. The thief would not only be compelled to imbed a new motor number and State seal, in a substituted wax, the composition of the original being a secret with the inventor, but he would also be unable to secure the key number which must coordinate with the motor number, through the fact that the key number is a matter of secret data in the State archives.



Ingenious seal and holder for motor car steering wheel, which is claimed to prevent theft

A Celluloid Compass Rose with Parallel Lines

THE celluloid compass rose, which has been in use in the Coast and Geodetic Survey for fifteen years, is so simple that no verbal description is needed in addition to the ¼ sized illustration. The method of using it is equally simple. By means of the system of parallel lines it can be placed over any point and oriented with the meridians on a chart. The circle will then serve as a true compass rose. While in this position if a mark is made on the chart opposite the graduation denoting the variation of the locality and the circle turned on its center until zero coincides with this mark, the circle will then serve as a magnetic compass rose.

The center of the rose is always placed over the point from which the bearings or courses are to be drawn. In the case of a point of departure or a "fix" the center is placed over the dot which represents either one. If a bearing is to be drawn from a lighthouse or other object to afford a "fix" the center of the rose is placed over the lighthouse or other object.

For laying out courses or bearings this celluloid rose has the following advantages over the customary use of the parallel ruler with the compass rose printed on the chart:

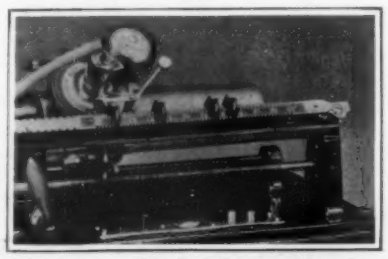
1. It affords a graduated circle of greater diameter than that of the compass rose on the chart, thus insuring greater accuracy and ease in plotting the directions of bearings and courses.
2. It avoids the chance of error due to the slip of the parallel ruler in traversing from rose to point or vice versa, particularly when the surface traversed is uneven.
3. The operation of plotting or reading courses and bearings is more rapid.
4. It does not require the same amount of skill in manipulation as the parallel ruler and unlike the latter it has no parts to get out of adjustment.

The Coast and Geodetic Survey is not authorized to manufacture the rose for public distribution, but the Superintendend will be glad to furnish any additional information which may be desired.

Taking Care of Errors with the Dictating Machine

A NEW invention provides dictating machines with a bell signal for the indication of errors in dictating. When the new indicator is used, the dictator checks on a slip the scale location of the *errors* instead of the corrections, as was the method used with the old way.

With the new method, the transcriber, upon receiving the slip, and while the machine is revolving before the beginning of dictation is reached, observes the points of correction appearing on the slip and sets stops, very similar in principle to those used on typewriters. These stops engage the bell ringing device which rings the bell five or six words in advance of the point where error has been made. In this way a timely warning is given the operator of the typewriter. She listens without writing until the correction has been heard, and then goes ahead and makes the correction. It is said to be much easier to make corrections by the use of this warning bell. Alma A. Zaiss, a court reporter of Kansas City, Missouri, is the inventor of the apparatus.



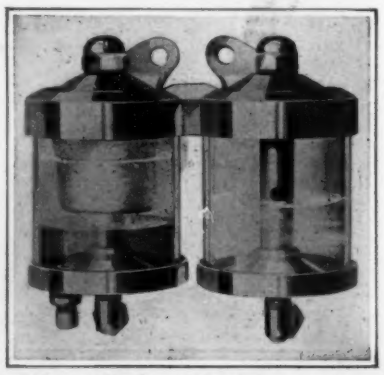
The stops on this dictating machine ring the bell to warn of changes and errors

Making Dirty Gasoline Clean

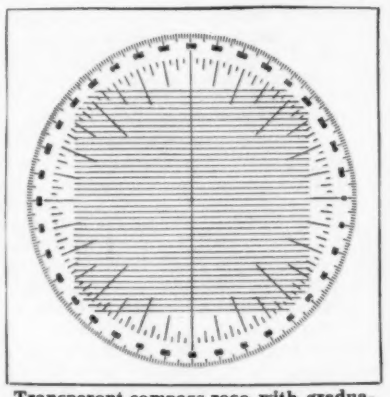
GASOLINE men have endeavored to meet the increased efficiency of the motor car engine by improving the purity of their gasoline. And they have succeeded to an extraordinary degree. Tests will show that nearly every brand of gasoline is absolutely pure when it is first refined. And right there is the trouble, because in transferring the gas from tank to tank and transporting it about the country the impurities creep in. Tanks and pipes are continually "sweating," introducing water into the gas. Rust and refuse are constantly dropping into the gas. When the cap is off to enable the gasoline to run from one tank to another the innumerable fine grains of dust always afloat in the atmosphere are picked up and absorbed by the fuel. By the time it reaches the tank of the motor car and is then again transferred to the vacuum tank or carburetor it is bound to be carrying an astonishing amount of foreign matter that cannot be absorbed by the motor. And these impurities are the cause of weak power, carbonized cylinders, poor carburetion and all the other evils so rightly charged to dirty gas.

The solution of the trouble is to filter thoroughly the gasoline just before it reaches the engine, and this is accomplished, it is claimed, by a new device. This device consists of two heavy steam gage glass tubes held in a nickeled frame, in the left jar of which is built a chamois strainer. The instrument fits on the instrument board and taps the gas pipe just before it reaches the carburetor or vacuum tank. The gasoline is then run into the left barrel of the device where it is strained through the two-way chamois filter and the cleaned or filtered gas is then run into the right barrel and thence to the engine. The left barrel contains all the impurities, dirt, rust, water, etc., left by the filtered gas and these impurities are drained off from time to time through the plug in the bottom. The right barrel contains the clean gas and thus provides a comparison between the gasoline in filtered and unfiltered condition.

It is claimed for the new device that it saves far in excess of its cost in increased mileage per gallon of gasoline at lower cost per mile of travel, to say nothing of the elimination of trouble—some carburetor adjustments, dirty spark plugs, carbonized cylinders, etc.



This new device, which is mounted on the dashboard, filters the gasoline



Transparent compass rose with graduations and system of parellel lines

At the other end of the wire— a waterfall or a coal mine

WHEN you press a button and flood the room with light, do you ever stop to think what makes it all possible? A lamp, you say. Yes, but how useless that lamp would be without current to keep it glowing.

Then let us travel along the wire, away back into the hills, where current is made. There we find a waterfall, or a connection with a coal mine, working night and day to produce power, and more power, and still more power, for man's use of electricity has only begun.

Fuel alone cannot supply all the electric power needs of the world, if there is to be any fuel left for other purposes. But annually, in the United States alone, there is enough water running in our rivers and streams to make forty millions of water horsepower. *Properly harnessed, this water now going to waste would develop electric power sufficient to release three hundred million tons of coal each year for other uses.*

In one part of the country, water power may be the solution of the electric power problem; in another part coal may be the answer; and oil may serve as fuel in a third. The towering falls of the Spokane or the wide expanse of the Mississippi now turn the wheels of industry, light hundreds of cities and afford convenience to millions of people.

To make electric power cheap, safe, plentiful and reliable has been and continues to be the aim of the General Electric Company. This involves first of all a knowledge of Nature's forces—how much coal is in the earth, how variable the amount of water in a stream, how best to utilize oil as fuel for huge steam turbo generators. Next comes the engineering problem of applying these forces to machines that generate electric power—specialized equipment for each source, whether water, coal or oil. And finally, the perfection of apparatus to insure uninterrupted service from power plants regardless of variations in the supply of water power or fuel.

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GENERAL ELECTRIC COMPANY

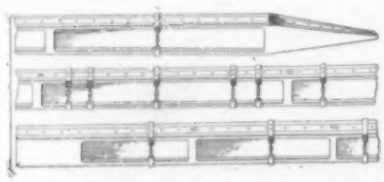
Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Aeronautics

AIRPLANE.—D. V. KAUFMAN, 24 W. 117th St., New York, N. Y. The object of the invention is to reduce to a minimum the danger involved in the use of airplanes. A further object is the management of a fuselage in the form of a stream line boat and an upper elevating plane in the form of a parachute arranged so that the fuselage may be connected to the front and rear parts of the upper elevating plane.

REINFORCED BEAM FOR WING PANELS OF AEROPLANES.—G. A. SCHNELLER, 426 Grant St., Buffalo, N. Y. The invention relates to beams for wing panels of aeroplanes in which metal plates are placed at the top and bottom of the beams in such manner that the plates can be held in position with bolts,



A PERSPECTIVE SIDE VIEW OF THE SPAR IN BROKEN PORTIONS.

brackets and turubuckles in conjunction with the wing post fittings. Among the objects is to provide greater strength to the beam with thinner wing panels, to afford the same facilities for nailing, screwing and placing fittings, such as cap strips webs and bracing wires as the all wood beam affords in addition to the greater strength.

Electrical Devices

ELECTRICAL TRANSMITTING APPARATUS.—H. K. HARRIS, 96 Victoria St., Westminster, London, England. This invention relates to an electrical transmitting apparatus provided with a keyboard, and somewhat resembling a typewriter which when the key is depressed causes a definite number of electrical impulses of any required nature to be produced and transmitted for the purpose of operating suitable mechanism at any required distance, for causing advertisements or the like to be exhibited or other desired operations to be effected.

Of Interest to Farmers

TRACTOR.—W. E. SIMONS, R.F.D. No. 2, Boyd, Oregon. The invention has for its object to provide a device especially designed for drawing farm machines in hilly and soft ground and in hill side work, and wherein the transmission is inclosed to protect it from dirt and the like. The machinel s provided with ground wheels, one of which is rigidly secured, the other revolubly mounted, giving advantages in side hill work.

Of General Interest

COMBINED PEN AND PENCIL.—J. J. HUGHES, Broadway and Highland Ave., Flushing, L. I., N. Y. The invention relates to writing implements and particularly to a combined fountain pen and magazine pencil. The primary object is to provide means by which the writing operation may be carried on either with a lead pencil or with ink. The device is capable of use either way without any special modifications of construction.

PORTRAIT FINGER RING.—J. HERBERT, 397 Woodward Ave., Detroit, Mich. The object of the invention is to provide a portrait finger ring arranged to provide a convenient means for holding a portrait, to allow of viewing the portrait from the outside, and to permit of replacing by another when desired. Another object is to make the holding means an ornamental feature, thus enhancing the appearance of the ring.

LANDING STAGE FOR VESSELS AND LAND VEHICLES.—A. GAFFNEY, 252 Alex St., Rochester, N. Y. The invention relates to landing stages for air vessels, naval vessels, merchant vessels, gasoline and electric driven cars of every character and containing power plant for propelling the landing stage hoisting and lighting. The device comprises spaced substantially parallel, rigidly connected pontoons, a superstructure supported by the pontoons and comprising a landing stage and hangar for aerial vessels, a tunnel structure between the pontoons and adapted to extend to the land to form a passageway.

ARTIFICIAL ANKLE JOINT.—O. A. INGEBRIGSTEN, 431 4th Ave., Pittsburgh, Pa. The invention relates to artificial limbs and has for an object the provision of an ankle joint which will permit an independent back and forth swinging movement in a vertical plane of the foot. By this construction the foot is given a more natural action as will automatically swing to one side in case a small object is stepped on near one edge.

PICTURE FRAME.—R. D. MORGAN, 171 W. 81st St., New York, N. Y. The invention relates to picture frames or similar holders for articles to be exhibited, and has for a particular object to deal with means for clamping a picture or article in the frame or holder and with means for supporting the frame or holder as an easel, or for hanging the frame on a wall.

COMPASSES.—P. B. RUCH, 2122 O St., Lincoln, Neb. This invention relates particularly to that class of compass which may be formed from a single piece of material, preferably round or flat wire, and attached to a pen, pencil or other marking instrument and in which the marking instrument itself forms one leg of the compass. Another object is to provide a relatively large friction bearing on which the marking instrumeat is mounted, to facilitate in maintaining adjustment.

CATERPILLAR GUN CARRIAGE.—E. RIMAILHO, 12 Rue de la Rochefoucauld, Paris, France. The object of the invention is to provide a device for facilitating the displacement of a caterpillar-gun-carriage by providing it, on one hand with a hand-driven mechanism enabling it, when in the firing position, to be set in any direction of objective by means of a simple hand operation; on the other hand, with means for facilitating its displacement to a great distance by furnishing it with a system of removable wheels, enabling it to have a running speed equal to heavy artillery carriages.

ARTIFICIAL HAND.—R. F. ARMSTRONG, La Cygne, Kan. An object of the invention is to provide an artificial hand capable of performing all of the important functions of a human hand. Another object is to provide an artificial hand of simple, durable construction, reliable in operation and easy and inexpensive to manufacture.

BEATER.—W. T. ZIMMER, 608 Forest Ave., Brooklyn, N. Y. The invention relates to ratan beaters, the object being to provide a beater in which it will be possible to have all the various parts subjected to an even wear, thus preventing the strands of the head and body becoming loosened, although the other parts are in good condition. A further object is the provision of a beater which may be constructed in various sizes, the handle being so constructed that no possibility of breakage exists.

GLOVE FASTENER.—L. REITER, 102 Westfield St., Providence, R. I. The particular object of the invention is to provide a snap glove fastener which will gain a more substantial grip and hold on leather, cloth, silk or other material to which the fastener parts are fixed, the fastener may also be employed for the purpose of hooking, joining, or snapping together pieces of material such as parts of wearing apparel, dresses and the like.

TRACK FOR HIGHWAYS.—C. T. ELDREDGE, 3750 24th St., San Francisco, Cal. This invention relates to a metal track for highways, and has for an object the provision of two smooth surfaced flat topped metal rails embedded in a road-way to take the greatest part of the wear and tear of heavy traffic. Another object is to provide light and strong metal rails with flat tops broad enough to obviate the necessity of using a great number of ties for the foundation of the rails

KNOCK DOWN DOLL HOUSE.—C. J. SCHMITT and K. R. SCHUNDLER, 724 Detmars Ave., Brooklyn, N. Y. An object of the invention is to provide a doll house formed of a plurality of units representing various rooms. Another object is to permit a child to readily assemble the various elements without the aid of a grown-up person. Another object is to provide a simple and a more elaborate house, the simple one being without a roof and front walls, while the more elaborate house is provided with both.

BUCKLE AND STRAP.—B. R. JOLLY, 51 Maiden Lane, Raleigh, N. C. The invention has for an object the provision of a buckle whereby a very thin structure may be used. Another object is to provide a buckle arranged with a tongue positioned to automatically engage openings in the strap for preventing accidental disengagement thereof. An additional object is the provision of a central section which may be pressed out for forming retaining eyelets for holding the buckle in position.

RAZOR STROPPER.—S. DYKTOR, 16 Platt St., New York, N. Y. This invention relates more especially to a small incased stropping mechanism for safety razor blades, confined in a cylindrical casing in order that it may fit in a traveler's toilet set. A purpose is to provide a stropping machine provided with stropping or friction rollers engageable with the razor blade edges and operated by a small crank.

INTERLOCKED FLOORING.—J. D. BUTLER, City Line and 66th St., Overbrook, Philadelphia, Pa. The invention has particular reference to flooring of the block, mosaic, or parquet type. An object is to provide flooring material made in uniform blocks or sections from small bits or scraps of material which commonly are discarded or wasted. A further object is to provide a flooring so designed as to enable an unskilled person to lay it on any ordinary level surface, without requiring nails or other hardware for holding or locking the parts in place.

BOX OPENING DEVICE.—C. S. HUMPHREY care Manhattan Can Co., No. 10 Bush Terminal Bldg., Brooklyn, N. Y. An object of this invention is to provide in an airtight box a simple and inexpensive means whereby the cover may be readily separated from the body of a box without necessitating the use of any hinged or moving pivoted parts, or the use of any prying means therefor. The invention provides means which may be readily applied to the ordinary airtight box having a bead on one of the members.

TICKET SELLER'S CASE.—A. FELLHEIMER, 7 E. 42d St., New York, N. Y. An object of the invention is to provide a case in which the tickets are positioned so as to be readily accessible at all times, while means are provided which will indicate the name and character of the various tickets without requiring an examination of the tickets, and whereby the tickets may be removed with quick facility when the case is in use.

COMPENSATING EXPANSION ROOFING CONNECTION.—W. B. SHARPE, 562 Hutchinson Bldg., Mt. Vernon, N. Y. Among the objects of this invention is to provide a nonmetallic simple and inexpensive means by which a covering may be applied to a roof and will allow relative movement between the covering and the roof, thus compensating for a movement caused by the difference in the relative coefficients of expansion of the main roof body and the covering therefor.

COMBINED SIFTER AND FUNNEL.—H. H. HOOPS, 72 18th Ave., Long Island City, N. Y. This device is more particularly intended for use by grocers for sifting out grapes from ground cork or sawdust and whereby approximately the desired quantity of grapes with adhering sawdust may be taken from the barrel, the exact amount separated from the sawdust and weighed, and any surplus grapes restored to the barrel and the sawdust, restored to top of the returned grapes.

MEAT HOOK.—G. D. KIRK, Old Point Rd., Beachwood Ave., Milford, Conn. The invention relates to a meat supporting device having for an object an arrangement whereby a quick release may be secured at any time. A further object is to provide a meat supporting hook in which an upward movement of the meat will cause the hook to release the meat and become locked in an open position.

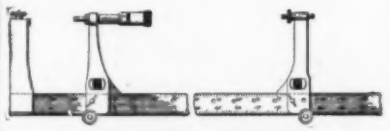
COMBINATION IRONING BOARD AND CHAIR.—J. J. DUNWOODY, 840 Forest Ave., Bronx, N. Y. This invention has for its object to provide a construction wherein the back of the chair will act in the double capacity of a back and as a supporting leg. Another object is to provide a chair with a folding back having an ironing board thereon, together with means which may be adjusted without the use of tools for converting the chair into a stand for the ironing board.

COMPOSITION BOARD.—E. D. MARTINET, 5922 Towne Ave., Los Angeles, Cal. The invention has for its object to provide an inexpensive strong composition board adapted to be used for either walls or ceilings, wherein the body of the board is composed of a composition reinforced by strips of pasteboard or the like. The board is formed from a composition consisting of ordinary building plaster, sawdust, extract of cactus juice, and heavy black molasses.

SPRING RETAINER.—W. B. THOMPSON, 91 Richmond Ave., Port Richmond, S. I. N. Y. The invention relates to retaining devices and has for its object to provide a construction wherein the spring remains in an enclosing member while in use. A further object is to provide a spring retainer for the springs of talking machines and the like, formed to slidingly fit into the barrel of the talking machine and connect one end of the spring rigidly to the socket.

Hardware and Tools

MICROMETER AND HEIGHT GAGE.—D. H. LEHIGH, 3920 Gladys Ave., Chicago, Ill. This invention relates to tools for mechanics and has for its object to provide a tool having as an essential part thereof a micrometer



A SIDE VIEW OF THE DEVICE.

and so constructed that measurements ranging from one inch to twenty-four inches may be easily made. Measurements are taken from the base to any number of inches required, the base serving only to hold th standard in an upright position.

EXTENSION WRENCH.—A. C. MARTIN, c/o W. L. Bessolo, Palace Hotel, San Francisco, Cal. One of the principle objects of the invention is to provide a wrench in which the jaws may be quickly and with little effort extended and adjusted to the size of the work, the construction being such that the wrench may be readily manipulated by one hand, and may be instantaneously adjusted.

PATTERN PUNCH.—W. ZIMMER, 130 Roosevelt Ave., Corona, N. Y. This invention relates more particularly to small hand-operated punches especially adapted for punching patterns. The prime object is to provide a device which while portable has at the same time sufficient weight to prevent movement thereof relatively to its support during the punching operation. The device is both simple and cheap to manufacture.

CAN OPENER.—L. OSMUNDSEN, 24 4th St., Brooklyn, N. Y. The invention relates to combination tools, especially adapted to culinary purposes, the primary object is to provide a can opener in which the top of a can may be cut in the ordinary manner or the entire top together with a portion of the sides of the can may be removed. A further object is to provide a can opener which is capable of use in operating on cans of various shapes and sizes.

PNEUMATIC CHISEL.—W. S. WHYTE, 1128 W. 14th St., Bedford, Ind. The invention has for its object the provision of a handle member associated with a pneumatically operated chisel which is so constructed as to absorb the shocks and jars incident to the use of the tool, the chisel member and handle-casing being provided with coöperating guide members, and the casing carrying spring members having their ends engaging within notches in the chisel member to provide for absorbing shock.

Heating and Lighting

COMBINED LAMP AND HEATER.—P. C. BROWNE, 329 Mohawk Bldg., Portland, Oregon. The particular object of the invention is to provide a device having means whereby it may be used either as a lamp for purposes of illumination or as a heater, and in each of these two respective capacities may be employed in a variety of different relations. The device is electrically operated and is so arranged that it may be used for toasting or light cooking.

SAFETY GAS COCK.—B. J. DIEHL, Dry Harbor Road and Cooper Ave., Glendale, L. I., N. Y. The invention aims to provide a device wherein the accidental displacement of the conventional rubber tube from the end of the gas-cock will result in the automatic shutting off of the flow of fluid. A further object is to provide a secondary valve for the nozzle in addition to the conventional turn valve, the secondary valve automatically cutting off the gas, should the tube be accidentally pulled off.

Machines and Mechanical Devices

ROAD SWEEPER.—C. E. BARRIE, 211 Barber Bldg., Brattleboro, Vt. The invention relates to sweepers which may be used for sweeping streets or roads under ordinary conditions, or may be used for sweeping snow or other matter in considerable quantities. Its

(Continued on page 656)

RECENTLY PATENTED INVENTIONS

(Continued from page 654)

further object is to provide an elevating device which will operate to collect the dirt while the vehicle is moving so that the street may be cleaned without shutting off general traffic.

AIR PUMP.—C. B. GOODSTEIN, 76 Bridge St., Struthers, Ohio. The invention relates generally to pumps, but more particularly to double-acting air pumps, the object being the

A SIDE VIEW PARTLY BROKEN AWAY IN SECTION.

provision of a simple, inexpensive mechanism which will expel air upon both up and down strokes of the pump plunger, and especially one which is capable of ready repair and convenient substitution of parts.

TAPE FEEDING AND CHECKING REGISTER.—J. A. GREENWALT, 1418 No. ½ St., Galveston, Texas. Among the objects of the invention is to provide a device in which successive characterized portions of a tape are exposed through an opening in the device, with means for checking or indicating the portions of the tape. The primary object is to provide a device with which a tape, including numbers or other features, may be checked or compared to verify the correctness of the numbers.

COTTON PICKING NOZZLE.—C. E. TAYLOR, Box 15, Rock Spring, Texas. The invention relates more particularly to a cotton picking nozzle for a vacuum or suction apparatus, the object being to provide a nozzle by means of which the effective action of the suction may be readily controlled with a suction line of constant pressure, the device being quickly adjusted and easily handled.

MOVING PICTURE MACHINE.—E. J. HADLEY, 142 Market St., Newark, N. J. The object of the invention is to provide an arrangement for causing film to be moved through the machine with a minimum amount of injury thereto while giving a maximum exposure. A further object is to provide a rotary presses and parts associated therewith for pulling with an even strain on the film so that the film will move in proper time and also the framing device without changing the operation of the presser.

CURRENT MOTOR.—H. C. CANADAY, Mayfield, Ky. This invention has for its object to provide a motor adapted to be arranged in any running stream, wherein a wheel is provided and means for supporting the same, the wheel being movable on the support to vary the depth of immersion of the working blades, and wherein adjustable mechanism is provided for deflecting the water from both sides toward the wheel.

TRAP FOR OIL WELLS OR PUMPS.—H. MCD. RILEY, East Los Vegas, New Mexico. The invention relates to oil wells or pumps and has for its object the provision of a pan or receptacle adapted for association with the upper end of an oil well casing or a pump tubing whereby surplus oil issuing from the discharge nozzle of the pump may be caught and run to a suitable receptacle whereby the great waste will be eliminated.

INK FOUNTAIN FOR PRINTING PRESSES.—J. F. FARHAM, 150 4th Ave., No., Nashville, Tenn. A specific object of the invention is the provision of an ink fountain in which the ink receptacle may be readily removed for cleaning and repair and a further object is the provision of means whereby the ink receptacle may be locked in positive adjustment with respect to the inking roller so as to maintain an even color in the printing throughout an entire job.

DISPLAY DEVICE FOR ADVERTISING FRUIT JUICES.—J. CAMINITI, care Vincent P. Donikee, 26 Court St., Brooklyn, N. Y. Among the objects of the invention is to provide a display device which will serve to visibly indicate or simulate the methods used in making the pure fruit beverages from the crushed fruit. A further object is to provide an advertising device which by visible motion of the mechanical parts will serve to attract the attention of the public.

PISTON RING.—J. MARSH, 8018 S. Peoria St., Chicago, Ill. The invention relates more particularly to rings used on piston rods of steam engines and steam pumps. The object is to provide a packing means for piston rods, that will provide steam tight joints in stuffing boxes or glands, and at the same time permit perfectly free functional movement of the piston rod at a low cost and with a minimum of wear and friction.

PLUG.—E. V. CROWELL, Box 611, Tulsa, Okla. The object of the invention is to provide a device especially adapted for providing water-tight seal at the bottom of a well for the purpose of shutting off a flow of water from below, wherein the arrangement is such that the plug may be introduced through the well casing and expanded at the desired point below the casing to seal the casing at this point.

IDLER FOR CONVEYERS.—L. DE YOUNG, 76 Richard St., Passaic, N. J. This invention relates more particularly to conveyers of the endless belt type. An object is to so construct idler pulleys for conveyers of the endless belt type that any number of pulleys may be used thereby adapting the same to use with belts of different widths. A further object is to provide a pulley which is readily taken down for the purpose of removal from the shaft.

PROGRAM CLOCK.—E. E. JACOBS, Ashland, Ohio. The object of this invention is to provide a program clock particularly adapted for use in colleges and schools where a daily program is carried out every day alike. Another object is to provide a clock particularly adapted for use in boarding hails where breakfast, dinner and supper calls may be made long and loud, also for use in department stores where one set of clocks go out at one time, another set at another time, etc.

SEWING MACHINE.—J. PARTMANN, 81 Bleecker St., New York, N. Y. The invention has for its object to provide a sewing machine, simple in construction and operation which is adjustable to make a straight or a zigzag stitch as desired. The special object is to provide a machine for stitching straw together, or sewing braid or other material, and for binding wire to hats, although the machine may be used for other purposes.

Medical Devices

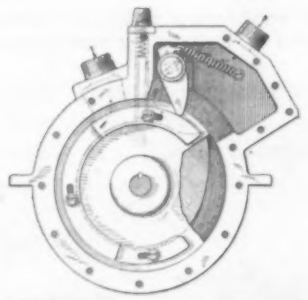
DEVICE FOR MOVING FLUIDS.—P. L. DE NOUY, c/o Rockefeller Institute, 66th St. and Ave. A, New York, N. Y. The invention pertains more particularly to apparatus for use in transferring fluids in surgical operations and other cases requiring cleanliness, sterility and absence of movable or corrodible parts. The object of the invention is to construct a device in such a manner that the rapidity at which fluid is transferred may be varied at the will of the operator, while at the same time preventing back flow.

Musical Devices

MUSICAL INSTRUMENT.—B. A. MORRIS, 230 Brotton St., Savannah, Ga. An object of the invention is to provide a musical instrument having a continually rotatable shaft with a plurality of toothed disks against which gongs are adapted to be pulled upon operation of press buttons on the finger board of the instrument to produce musical tones varying in pitch. The instrument is operated by a spring motor which rotates continually until the spring runs down.

Prime Movers and Their Accessories

ENGINE.—A. R. STANLEY, 773 Dudley St., Boston, Mass. The invention relates to a rotary engine in which the expansive force of



SIDE VIEW WITH PART OF CASING REMOVED.

steam may be utilized. An object is to provide a cut-off which shall be capable of varying the quantity of expansive fluid, which may be so regulated as to permit a sufficient quantity of expansive fluid to be injected into the engine to keep the same at a nearby constant speed even though the load may be varied.

VALVE GRINDER CUP.—C. D. ROSENCRAS, 856 Miliani St., Honolulu, Territory of Hawaii. The invention relates to devices used for holding the valves of internal combustion engines in order to grind the same. More particularly the invention relates to means for rendering the valve air-tight and for facilitating the removal and replacement of the cup, the invention further contemplates mechanism for the purpose of adapting the vacuum cup valves of different types.

PORTABLE POLISHER AND GRINDER.—C. CAMPBELL, 350 Park Ave., Rutherford, N. J The invention has for its object to providea construction which may be used on a stationary stand, or as a movable grinder. Another object is to provide a polisher and grinder especially adapted for boiler heads and the like, the structure being such that the grinding surface will automatically adapt itself to the slant of the article being ground.

FILLER SLUG.—M. FIRST, 611 Jefferson Ave., Bronx, N. Y. The invention has particularly to do with cast metal filler pieces which may be cast in linotype or other similar machines, an object being to provide filler slugs which are adapted to be assembled and provide a space in the type set up. It is the purpose of the invention to cast a slug which can be assembled to save metal and weight of the type set up.

TOOTH CONSTRUCTION FOR DIGGING BUCKETS.—J. W. KITTREDGE, Box 393, Baberton, Ohio. Among the objects of the invention are to provide sharp teeth thereby enabling them to more quickly enter the ground without sliding over it, to penetrate the ground after entering, and to enable a drag bucket to enter the ground at a less angle with the line of pull, thereby economizing power and facilitating the digging operation. To provide teeth of such a form that dull ones may be removed and sharp ones easily inserted.

Railways and Their Accessories

CONTACT SHOE FOR AUTOMATIC TRAIN STOPS.—M. B. BULLA, 209 Caples Bldg., El Paso, Texas. This invention has particular reference to a contact shoe to be carried by a locomotive or some other part of a moving train for coöperation with any suitable brush or track appliance arranged along the railway. Among the special objects is to provide a device having the function of making infallible a proper electrical contact with the fixed brush irrespective of any accumulations of snow, ice, sand or the like that might coat or clog the brush.

BED RAIL.—O. C. WYSONG, Decd., Executrix, Fannie I. Sysong, 337 N. Elm St., Greensboro, N. C. An object of the invention is to provide a bed rail the principal feature of which lies in extensible blocks adjustably mounted in the extremities of the rail, by the use of which the length of a bed may be increased. Another object is to provide a crimped or fluted metallic bed rail having blocks bearing bed hooks inserted in the ends, said blocks being susceptible to adjustment, and provided with spacer blocks for preventing rattling.

Pertaining to Recreation

TOY.—J. P. FLIPPO, P. O. Box 327, Covington, Va. An object of the invention is to provide an ornamental hand spun top fitted with audible tone producing elements which will be pleasing in appearance and use to children and will be instructive in certain mechanical principles relating to rotation of masses, rotating colored or painted parts which will produce a dazzling complexity of visual appearance.

Pertaining to Vehicles

COMBINED WAGON AND AUTOMOBILE DUMP.—F. J. LEECH and W. H. MYERS, Box 53, Ottawa, Ill. The invention relates to vehicle dumps of the type in which the wheel supports for the vehicle are adapted to assume a position for tilting the vehicle bodily. More especially the invention relates to a dump in which provision is made for receiving and dumping either a wagon or an automobile or truck.

WATER CARRYING HOOD FOR STEAM AUTOMOBILES.—A. R. CARTER, Gulfport, Miss. One of the principal objects of the invention is to provide a hood in the nature of a reservoir for water whereby means is provided for conveniently carrying a supply of water in close proximity to the boiler, thereby reducing the amount of pope fitting, length of pipe lines, and also doing away with the necessity of carrying a water tank hung at a distance from the boiler.

TIRE AND RIM.—A. L. BAKER, R.F.D. No. 2, Jerome, Mich. The invention has for its object the provision of a tire and rim in which the tire includes an outer casing, an inflatable inner tube, and an auxiliary inner casing engaging the inner periphery of the tube and interengaged with the outer casing, the outer casing being held in position by a rim whereby all the parts will be firmly held associated and a durable tire structure provided.

AUTOMOBILE LOCK.—I. P. CARPENTER, 70 Bedford St., Waltham, Mass. Among the objects of the invention is to provide a lock in the nature of a tongue adjustably carried on the steering column and movable into position between any two adjacent spokes of the steering wheel for presenting an obstruction to prevent turning the wheel. With this device it is not necessary to have the steering wheel adjusted in order to be locked, the tongue projects between any two spokes.

WHEEL.—G. REINER, 33 Laconia Ave., Elmhurst, L. I., N. Y. The invention relates more particularly to wheels having elastically supported tire sections which cushion the jars and vibrations and provide an easy running vehicle support. A further object is to provide a wheel with a series of tire segments, each segment capable of independent cushioned movement.

AUTOMATIC COUPLING.—J. W. BULLER, Hilisboro, Kans. The invention particularly relates to automatic couplers for trucks and trailers, and has for an object to provide a simple and strong device which will not become accidentally uncoupled, but which may be quickly and easily uncoupled manually. Another object is to provide a coupler wherein two interlocking parts are presented, one of which is tapering so as to easily enter the other part during the coupling operation.

STEERING DEVICE FOR MOTOR VEHICLES.—W. L. THOMPSON and W. E. ELAM, Greenville, Miss. An object of the invention is to provide mechanism in connection with a motor vehicle for permitting the vehicle to be steered fowardly or in the reverse with equal facility, and with the same movements of the steering wheel in either direction. A further object is to provide dumping mechanism in connection with the motor vehicle operated by gravity to dump, and restored by power, and with latching mechanism for the rear gate.

END GATE FASTENER.—L. P. WELLS, Gering, Neb. The invention relates to end gate fastenings for wagon boxes. The object being to provide in a hinged end gate combined hinge and metal cleating devices, and end gate clamping mechanism, by use of which the end gate will be of a far more durable and practical nature.

AUTOMOBILE LIGHT GLOBE HOLDER.—H. B. OWENS, Alton, Ill. The invention particularly relates to holders for electric light globes used on automobiles. The main object is to provide means whereby a reasonable supply of extra or spare globes may be at hand at any time, and carried conveniently and safely against accidents. A further object is to produce a simple, cheap and efficient holder that may be attached to the dashboard without any changes in the car itself.

AUDIBLE ALARM FOR AUTOMOBILES.—H. MORGAN, 47 W. 34th St., New York, N. Y. This invention relates to safety appliances for vehicles, and has particular reference to such devices adapted to be used on automobiles provided with internal explosion engines. Among the special objects is to provide an alarm adapted to be set into operation automatically in connection with the exhaust pipe when the engine is started or the machine operated by any one without authority, and hence the meddlers scheme will be frustrated.

Designs

DESIGN FOR AN ELECTRIC STOVE.—W. B. GILMER, Savannah, Ga.

DESIGN FOR A RECEPTACLE.—C. S. HUMPHREY, c/o Manhattan Can Co., Bush Terminal No. 10, Brooklyn, N. Y.

Sounding with Sound

(*Continued from page 642*)

The sound is carried directly from receiver 2 to the ear. Since the sound strikes 1 first, the path of the sound has to be lengthened a little in order to bring it to the ear at *A* in exact phase with that from receiver 2. This is done by inserting a "trombone" slide section in the tube and then drawing out this slide as indicated. Similarly the sound tube from receiver 3 has to be shortened in order to bring the sound from all three receivers in phase at *A*. As is indicated in Fig. 5—2, the sound is brought to phase, if coming to the receivers at right angles, by making the tubes all the same length. If the sound is coming from the other direction, however, the tubes are arranged as in Fig. 5—3.

This trombone compensation device as actually used is shown in one of the accompanying photographs. It is called the "2-spot" acoustic compensator and consists of a grooved plate, with a movable stop, on another plate. In the early equipment the sound was taken from this stop to the ear and as it was rotated from side to side, one tube was lengthened while the other was shortened. As the assembled view of this device shows, the top plate was used as a dial and was calibrated to show the angle from which the sound was coming. The correct position was easily found because the sound always is loudest when received from the three receivers in phase.

But it was found that much more accurate results could be obtained if a number of receivers were used, stretched out in a long line, instead of a simple set of three. Twelve receivers were finally determined on as an ideal number. But this added complications to the compensating mechanism. The system fully worked out is illustrated in Fig. 5—4. The receivers, as in the first instance, were used in sets of three, and the sound reaching each set was brought in phase, at the points *A*, *B*, *C* and *D*. But just as in the case of the underwater receivers, the sound would reach the point *A* before it reached *B*, *C* and *D*. So a compensator was placed at *E* and it brought into phase the sounds from *A* and *B* and another compensator at *F* brought into phase the sound from *C* and *D*. The sounds from *E* and *F* were taken through a final compensator to the ear and in this final compensator the sounds from all twelve of the receivers were brought into phase or "focused," so that they were heard as one sound of maximum intensity.

The problem of adjusting the seven compensators was simplified by the fact that all of them had to be turned in the same direction at the same time and in exactly the same degree. So they were all geared together and all turned by a single hand wheel. The indicating dial was attached to this wheel.

The electrical compensator, which is the final form of the instrument, has been developed from the acoustical machine. It has the advantage of being more robust in construction, easier to install and repair and is a more sensitive instrument. Microphones, in a special rubber housing, are used as the underwater receivers, and since electric wires are employed instead of pipes, the compensator can be located on the bridge of the ship where the navigator has easy access to it. By the use of vacuum tube amplifiers, the sound can be brought to any degree of loudness.

It was found, too, that it could easily be determined whether the sound was coming from the port or starboard side of the vessel by using two sets of twelve receivers, with one set on each side of the bow of a vessel. By taking the sound of the right hand set to the right ear and the other set to the left ear, it was easy to determine from which side the sound came by the relative intensity.

The arrangement overcame the greatest difficulty encountered in similar detecting devices, that of picking out a particular sound without interference from the noises of the ship's machinery, or of other ships. By "focusing" on the particular sound wanted, not only is that sound brought to a maximum intensity, but all other sounds are reduced to a minimum.

The surprising discovery was then made that the only sounds heard by the device were those reflected from the bottom. In trailing a submarine to sea, its machinery could be distinctly heard in shallow water, but in mid-ocean no sound could be caught, although it was still nearby.

While this fact limited the usefulness of the machine as a submarine detector to shallow waters, it has been the principal factor in making it useful to commerce. It would not be possible to determine depth of water under the boat, or to determine ranges of ships or submarine bells, were it not for this fact.

Thus, in determining the depth of water under the vessel, we "focus" on the sound of the ship's own propeller or on the sound of a submarine bell located some distance from the receivers. The angle indicated by the instrument is the angle which the sound makes with the bottom, as indicated in the large drawing.

An equilateral triangle is formed by a line between the propeller or bell and the receivers, and the path of the sound from the propeller to the bottom and from the bottom to the receivers. Since we know the distance from the receivers to the propeller and know the angle of the reflected sound, it is a simple geometrical calculation to determine the depth, as represented by the line *H*. As a matter of fact, no calculation is necessary because the disc on the compensator has already been calibrated to indicate the depth in fathoms.

Soundings in very deep water are obtained by noting the time which elapses between the sounding of a submarine bell and the receiving of the reflected sound.

The approximate range of nearby ships can be determined by reversing this process. We know the depth under our own ship and supposing the depth under the other to be nearly the same, we determine the angle of reflection from the bottom of the sound from the other ship and it is then easy to compute the distance.

For determining greater ranges, as for instance, determining the range of a lightship equipped with a submarine bell, an "eel," consisting of twelve microphones in a streamlined housing, is trailed on a cable behind the ship, and this device is used as a receiving station also. The angle at which the sound reaches the "eel" is determined, and also the angle at which the sound reaches the ship. The distance between the eel and the ship is known and thus one side and two angles of a triangle are determined and the distance of the lighthouse from the ship can be computed.

In actual use some remarkable results have been obtained. The U. S. S. "Parker," while maneuvering in the North Sea in a dense fog, reported that she avoided two collisions in one day by the use of this listening device. On another occasion a submarine fitted with the device made a complete circuit of Long Island in a very dense fog, depending on the hydrophone entirely for obtaining her bearings. Dr. Harvey C. Hayes, one of the scientists who developed the apparatus, while on board a U. S. Transport was able to locate the Nantucket lightship within two degrees at a distance of 37 nautical miles while the ship was steaming at 15 knots. Upon approaching New York harbor from one to three bell signals could be heard and accurately located at one time, making it possible to enter harbor with safety in a dense fog.

"It would seem," says Dr. Hayes, "that navigation during conditions of low visibility can be made perfectly safe if each boat is equipped with a good submarine sound detector and a submarine signal device such that its signals can be distinctly heard for a distance of at least five miles. During fog each boat should periodically signal by code its course and possibly its speed. By picking up such signals on its listening device any boat can avoid collision since it will know the bearing, course and speed of all ships within a radius of five miles.

"Such arrangement should not only eliminate all possible collisions but should enable our whole merchant marine to keep moving at practically full speed at all times."

Dr. Hayes believes it will actually be possible to navigate a vessel by noting depths and "listening" to the kind of bottom. For instance, a different sound quality is reflected from a mud or sand bottom than from a rock bottom and after the operator has become familiar with the machine he will be able to tell just where he is by the depth and the quality of sound he hears.

We are indeed beating our swords into plowshares.

Making the Milkman Fear the Pump

(Continued from page 643)

lieve the method to be reliable down to three per cent. For the application of the freezing-point test Dr. Horvet has designed a thermometer and attachments by which freezing point readings may be made easily with no error exceeding .001 degrees. This thermometer has a range of but three degrees Centigrade—from one degree above zero to two below. A one-degree division on the scale is approximately ten centimeters long.

It is found that the elevation of the freezing point above the normal point for milk, and toward the normal zero of water, is directly proportional to the amount of added water, right up to the zero reading. No matter how much or how little water there be in the milk as produced, this is so taken up in dissolving the other constituents that the freezing point is practically the same. But added water does not take up the same relation with the solids and fats as the water that belongs to the milk, and accordingly affects the freezing point as the natural water-content cannot. For example, a freezing point of —0.49 degrees indicates 10.9 per cent added water; of —0.518 degrees, 5.8 per cent; etc.

Machinery for the Beet Field

(Continued from page 643)

digger as it were. It is about six feet wide and 15 long, weighs about 1,200 pounds. From two and a half to three acres can be topped and dug in a day at an actual saving of thirteen dollars an acre.

The machine is mounted in front on bearings that admit of turning practically square around so that the rows of beets can be dug clear to the end and the machine turned round in the smallest space and go back on the next row. The wheels are at proper space so as to run between the rows and not run over and damage either undug or dug beets.

The action of the roller and disk is such that when the disk hits the beet to sever the top, the beet is not pushed forward, even though the ground is wet or sandy and loose. The beet stands upright and meets the disk squarely so the top is severed evenly, uniformly and squarely. This also has been a problem. In previous models Mr. Kramer used a long knife in place of the revolving one and found difficulty in getting the top cut squarely, as the knife had a tendency to push forward the beet in which case the top was cut off at an angle.

Succeeding in Radio Engineering

(*Continued from page 644*)

sive research laboratories and employ a full staff of men well qualified to carry on research work of the deepest dye. At the present time many millions of dollars are being expended annually on radio research. In fact, most of the radio engineers today are engaged in research work.

Those who contemplate a career in radio engineering will be interested to know that the great General Electric Company has recently turned its attention to the radio field. The entire interests of the Marconi Wireless Telegraph Company were purchased outright and a new concern, The Radio Corporation, formed which is part of the General Electric interests. Nothing could argue more strongly for the future of radio than this.

No young man could wish for a more promising field. Radio science has just reached the point where it is receiving extensive application and yet it is in its infancy. It is where electrical engineering was thirty-five years ago. The opportunity to make a career while being able to stamp around "on the ground floor" is here.

Checking Up Einstein

(*Continued from page 646*)

Morley of Western Reserve University, who had also assisted Michelson. So great was the scientific interest in the experiments that funds were appropriated by the Rumford Committee of the American Academy to finance a more thorough test.

The present apparatus was then constructed of steel and every effort was made to avoid the criticism which Dr. Michelson had to meet. In addition the apparatus was made much more sensitive and many possibilities of error were eliminated. Morley and Miller used this apparatus for a long series of experiments in 1904, 1905 and 1906 and their work verified in every way the results of Michelson.

It was then suggested that perhaps no drift was detected because the experiments were conducted in an enclosed basement room, and that if the apparatus were taken away from buildings, a different result would be found. Although this was an admission that it had been at least proven that ether does not pervade all matter, to meet this objection the apparatus was moved to high ground, away from buildings and the experiments repeated. The instrument was protected from the weather only by a transparent housing. The remarkable thing is that in this case deflections were consistently noted. Finally both experimenters decided on a vacation and during their absence the land on which their station was set up was sold. The machine was taken down by assistants and stored at Case School.

The experiments, at that time, seemed to have led into a sort of "blind alley," and since no explanation was offered, science calmly forgot the matter and the experiments were never carried to the point of positive results.

As Einstein himself has said, however, these experiments furnished the incentive for the development of his revolutionary theory. Their repetition has been urged as a matter of prime scientific interest.

What About Our Wine Grapes?

(*Continued from page 648*)

Panama Pacific Exposition. Those that won the chief awards were better than anything of the kind that can now be found on the market whether made from California or eastern grapes. In the old days the market for all varieties of grapes grown in California was so assured that little effort was made to compete with the eastern manufacturers of grape juice, but now that the wineries can no longer buy the bulk of the crop, many people are turning their serious attention to the manufacture of a superior quality of grape juice that will win a place in all the markets of the world. California-made champagnes and wines were slowly but steadily building up a reputation for quality and excellence equal to that of foreign wines, and if the dry wave had not stopped this progress, the western wines would some day have won their way to the top, and the same quality will now be put into the new products to be made from the fruits of the vineyards.

Another outlet for wine grapes is in their use for the making of vinegar. While apple vinegar has held the center of the stage in the United States, wine or grape vinegar has been the standard in most European countries. Compared to apple vinegar, grape vinegar has a higher flavor and greater strength, so that even if it is necessary to sell it for a higher price, it can be used more economically than ordinary vinegar.

The making of vinegar from grapes usually requires from 6 to 10 months, and there are several processes for doing this. The present equipment of many wineries can be utilized, to a large extent, in the making of vinegar, and the industry possesses considerable opportunities for expansion.

The utilization of the various by-products of grapes is receiving the consideration of government experts, and it is thought that considerable salvage can be made from this source. The pomace from a ton of grapes weighs from 250 to 350 pounds and contains valuable matter. It contains about 15 per cent of dissolved solids, principally sugar, and some cream of tartar. The seeds contains about 8 per cent of an oil valuable for table use and for industrial purposes. The press cake from which the oil has been extracted is used as a stock food, or the tannin content can be extracted by leaching.

Directing the Detourist

(*Continued from page 649*)

distance only to admit people living on road. TURN. You Cannot Get Through." This board was "snapped" in Madison.

I should record also the public spirit of some highway authority in Doniphan County, Kansas. Near the town of Troy, on the Pike's Peak Ocean-to-Ocean Highway, a necessary hyphen to our course was missing. Very considerately a sign had been set back at the last cross road which could accommodate us, "Bridge out. Go ¾ mile east, then north." We did it. Thanks.

Some contrast, that, to another experience in the Sunflower State, when we mislaid an hour's time and temper trying to get around a blockade in the edge of a county seat. No directions were posted and no persons were present to respond to a "Show me." Ultimately our unguided "swing-around" led us from dry to wet earth and that humiliating position of having plenty of power but no traction! The rear wheels spun and got hot and smooth and "smelly." We had chains along, but had not needed them up to that mud hole. Some neighborly natives came to the rescue with spades and kindling wood and shoulders. Yet we'd much rather pull some other car out of a hole than be pushed out ourselves!

The townsfolk or farmers living near a break may know where to drive to dodge it and return to the proper path beyond, but in these days of the prevalence of motor vehicles practically any road may upon occasion carry passenger cars or freight trucks from the next county or from the far side of the state, while any *marked highway* presumably *invites trans-state strangers* to come and ride over it. As *tourists* or as *detourists*, why not lead them safely on?

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Business and Government

(Continued from page 650)

number of fruitless days spent by high-salaried business men in ante-chambers of one official after the other, sometimes for several days before finally reaching the one person who is able to give a definite answer, the aggregate in lost salary and time alone would amount to many millions in the course of a year. Business men should be able to come directly to the Department of Commerce and there find an official who is familiar with a particular phase of industry, transportation, or finance, or who could at least lead an inquirer direct to the proper official in the proper department or bureau of the Government who can give satisfaction. We try to do this for you now; we could do much better with a little assistance. At any rate, come to our commercial department with your commercial matters and we will be your guide and counselor.

Improvement Necessary in the Statistical Service

The statistical service of imports and exports must be improved. There has been no increase in the personnel to handle an increase in our foreign commerce of about 500 per cent. Moreover, there are many statutory salaries in the statistical division, both in Washington and in the custom house in New York, that have not been changed for many years past. Many more machines are necessary, and also a well-trained and well-paid personnel to operate them. The bookkeeping of the foreign business of the United States is the biggest bookkeeping job in the world. If you are engaged in foreign commerce—or, for that matter, in any commerce—the balance sheet of the nation's commerce is just as important to you as the balance sheet of your bank or of your own company. We have recently estimated that our national foreign trade bookkeeping can be put on a modern and prompt-service basis for about $400,000.

Another service that would mean many thousands of dollars' saving and also many hundred thousand dollars in sales is at present being handled by one clerk because of inadequate appropriations. This refers to the World Trade Directory of firms that is being compiled abroad through the coöperation of the Consular Service. Detailed information regarding the principal importers of foreign countries is coming into the Bureau of Foreign and Domestic Commerce from the consular and department officers. This is not a published directory, but a card index. From these cards trade lists, classified according to the nature of the business, are being prepared as fast as this one clerk can do it. On these trade lists is indicated not only the nature of the business but the relative size and importance of the firm in the community. The trade lists that are compiled in this way make it possible for you to know that every catalogue and every letter that you send out goes to a going concern. Above all, it makes it possible for you to make your quotations on a sound basis, and not make the fatal error of quoting to some insignificant firm your rock-bottom export prices, and thus, perhaps, killing the business that you might develop with the big importer, from which the little fellow buys. This service that has been hitched up ready to go for more than a year is still held for lack of appropriation. Although not a credit agency, these lists can be of the greatest possible service to every firm seeking foreign markets.

The business men of the United States through their organizations should work out the system that they deem wise for defining, enlarging, improving, and coördinating the diplomatic and commercial activities of the Government and present it without delay to their representatives in Congress for proper legislation. I believe that fairly direct and simple legis-

lation could coordinate the two, and still leave diplomacy to the diplomat and commerce to your business men's department. The Department of Commerce is the business man's department. He can make it what he wants it to be.

Barbados an Oil Field

BARBADOS is very likely to become another of the oil producing fields. A British-American company has been carrying out a thorough examination of the island, the results of which have proved that not only are there oil deposits in several districts, but that some of these deposits are considerable and very easily worked. The writer, when in Barbados recently, had an opportunity of visiting some of these districts, in company with the engineer who has been making the surveys. Not alone did he see conspicuous evidence of large areas of strata, but in many places there were surface exudations of great promise. These plainly indicated the existence of a very thick oil suitable chiefly for lubricating.

The section visited is known locally as the Scotland hills, and embraces all that portion of Barbados which has any altitude to speak of; most of the island presents a low, rolling surface. The Highlands referred to, of which Mt. Hillaby rising to 1,000 feet attains the highest altitude, are in the center of the island, the hills extending toward the east coast with a range running northeastwardly. The most promising oil region appears to be the coast elevations in the vicinity of Hackleton's Cliff, one of the famous scanic points for tourists. Here some years ago an oil well was sunk and exploited by a local proprietor and a considerable quantity of very high grade oil was obtained, which was marketed chiefly in Russia at a very remunerative price. This well was very near the shore and its having become exhausted was due not to lack of oil in the immediate vicinity, but to the boring having been made on the wrong side of the antecline. This is shown by the exudations, as well as by the nature of the strata, just back of the old boring. In fact, so sanguine is the company's engineering of good results being obtainable in this region that he has selected it for the first experimental well, which is now being sunk.

Apart from the Highlands, however, the surveys have shown that there are other localities in the island where oil deposits exist. One of these is in the extreme north, in the parish of St. Lucy.

Several tentative surveys of Barbados have been made at various periods, but this is the first time that the work has been undertaken in so thorough a manner, and by an engineer whose experiences in oil fields have been so extensive. Some obstacles in the past, it appears, were encountered on the part of the local proprietors who utilize all the land in the sugar industry, but these obstacles have been removed in the present instance and an agreement made with the land owners for working the properties.

One of the difficulties encountered in carrying out the surveys is the cultivated state of the land, most of it being covered by growing canes or by the refuse of recent cuttings. Except in the comparatively few exposed areas, where the oil strata is very plainly marked, it was only by induction that the work could be carried out.

Owing to the geological construction of the island, unique among all the West Indian islands, the actual labor of exploiting the oil beds will offer no difficulty whatever. As at Trinidad there are no forests nor swamps, and the farthest central point is within three miles of the coast. Labor is plentiful and cheap. The only obstacle, apparently, lies in the surf-beaten coral reefs which fringe the coast in almost all directions; to surmount this break-waters would have to be built and excavations made in the reefs. The general construction of the island shows a coral formation, the coraline terraces rising conspicuously one above the other toward the center of the island. The Highland district is composed of sandstones, clay and radiolarian earth. Under the less disturbed strata of the coral terraces, which conceal the tertiary bed, it is believed, lie the high grade petroleum deposits which it is now proposed to develop in a serious manner. —By *C. T. Mason.*

Soapstone

THIS is a term that has been loosely applied to several varieties of rock with differing chemical and physical properties. Some soapstones are hard, being only slightly altered from serpentine, and others are soft and contain more talc. Some varieties have a definite grain and others are composed of interlocking prismatic crystals. The difference in properties effects the suitability of various soapstones for different uses. In the construction of fabricated forms, hardness, toughness, and absence of grain are most important, but in the manufacture of foot warmers, griddles, and heating stoves for fireless cookers, resistance to heat and retention of heat are more important. Thus soapstone from certain localities in Virginia is more valuable for fabricating than for heat retention, and certain Vermont soapstones are superior for heating uses. An investigation of the properties of various soapstones and a classification by such properties would be most valuable.

The market for soapstone in fabricated form, that is, in sinks, laundry tubs, trays, table tops, etc., is dependent largely upon new building construction. During the war and the attendant depression in the erection of buildings for dwellings or commercial use, the normal market for soapstone largely disappeared, but Government orders partly compensated for this loss. After the signing of the armistice, building activity did not begin and the demand for soapstone was light. Within the past few weeks, however, conditions have begun to improve and when the building boom is fully developed the market should return to normal or even better.

Tungsten vs. Molybdenum

AN interesting summary of the consumption of tungsten in 1918 based on questionnaires distributed by the Bureau of Mines shows that the tungsten used in the making of tungsten powder, ferro, and acid, from May to December, 1918, amounted to about 7,500,000 pounds, from which it is estimated that the total tungsten used in such products for the calendar year of 1918 amounted to about 10,000,000 pounds and that the amount of tungsten used in making malleable products during the same time was approximately 210,000 pounds. The quantity of high-speed steel made from May to December, 1918, was nearly 30,000,000 pounds, from which it is estimated that the total weight of such steel in the year was somewhat in excess of 40,000,000 pounds; the tungsten content was probably nearly 7,000,000 pounds. The tungsten steel made from May to December, 1918, was in excess of 45,000,000 pounds, from which it is estimated that the total quantity produced in 1918 was approximately 62,000,000 pounds. The amount of 60 per cent concentrates required to make the tungsten powder, ferro, and acid used in 1918 was approximately 13,000 tons, assuming that one ton of 60 per cent concentrates is reduced to 760 pounds of contained tungsten in ferro.

During the past 18 months about 50,000 tons of molybdenum steel has been made in this country with very encouraging results, and it is now understood that some of the leading alloy steel makers believe that steel containing a relatively small quantity of molybdenum is superior to any other known material for high-grade airplane parts, such as crank shafts.

Shrinkage in Compression Wood

COMPRESSION wood is a term applied to wood of an abnormal growth, which is considerably heavier than normal wood and is usually further distinguished by very wide annual growth rings, a lack of contrast between the spring and summer wood, and a relatively dark color. How this abnormal growth is caused is not definitely known, although the theory has been advanced that excessive leaning of the tree during growth produces it, the compression wood being formed on the lower or leaning side.

Structural timber containing compression wood was recently received for examination at the Forest Products Laboratory, Madison, Wisconsin. The timber had failed in tension in the compression wood. Large cross breaks had opened up across the grain, and rendered this portion of the timber useless in withstanding further stresses. The compression wood was very brash and exhibited low strength in mechanical tests, except n compression parallel to the grain, in which it was about equal to the normal wood. Its specific gravity was considerably greater than that of the normal material.

The chief difference between the normal and abnormal wood, however, was in the matter of shrinkage. The compression wood was found to have a longitudinal or end shrinkage six times as large, and radial and tangential shrinkages less than half as large as those of the adjacent normal wood.

In the beam examined, the tendency of the compression wood toward excessive shrinkage had been resisted by the normal wood, with the result that the compression wood was actually pulled in two.

Acetylene as a Substitute for Gasoline in Motors

THE idea of using acetylene as a motive power is by no means new, but slow advance has been made, owing to rapid development in the design of engines. On account of the gasoline shortage, the subject is being revived. Most trials have been made in Switzerland on account of the waterpower available and the consequent cheap production of carbide.

Acetylene can be utilized in two-stroke, four-stroke, and Diesel engines, but attempts are chiefly confined to the four-stroke, as this type is more prevalent at the present day. The original theory was that special motors must be designed and manufactured for acetylene power; but that this no longer holds good appears from figures showing the proportion of acetylene gas and air necessary for correct combustion.

There is no distinct carburetor for use with acetylene, but a mixing valve is employed which allows for the variation of the amount of air which is added to the strong gas; and if a small amount of warm water be drawn into the cylinders with the gas in the form of a spray it is advantageous. A difference in the compression is found necessary when comparing acetylene motors with gasoline motors; but increased power and higher efficiency can be obtained by using acetylene gas with gasoline or paraffin.

For use in automobiles, acetylene may be carried as dissolved acetylene in the familiar steel cylinders, or the gas may be generated on the car; but the former method is not recommended, owing to the small radius of action obtainable and the difficulty of refilling the cylinders.

Comparisons in the performance of a 30-horse-power motor when using gasoline and acetylene respectively are then quoted. When using acetylene, the motor is less liable to overheat, and the cylinders and valves keep unusually clean. As regards oil consumption, this is heavy when pure acetylene gas is used, but when the water-spray is jointly drawn into the cylinders, the consumption is less than that of gasoline engines.

NEW BOOKS, ETC.

HEATON'S ANNUAL. The Commercial Handbook of Canada and Boards of Trade Register. 1920. Toronto, Canada: Heaton's Agency. 8vo.; 550 pp.; illustrated.

If there is anything you need to know about our thriving neighbor to northward, this Annual will inform you, or will put you in the way to getting the information. Commerce and industry, government and finance, are thoroughly covered by the text and maps of this convenient volume. It is the standard authority on the Canadian customs tariff, the official register of boards of trade. The industrial opportunities of all important places are outlined; the *Shipper's Guide* takes in every banking point, and there is a list of financial institutions, with their standing. Its directories include government officials, members of Parliament, foreign consuls, railways and steamships, customs brokers, and educational institutions. The section on natural resources has all the facts and figures of agriculture, forests, fisheries, mines, and water powers; and the items of general information are innumerable. All is brought strictly up to date in the 1920 edition, which will command the same wide use and well-founded confidence as its forerunners.

PRACTICAL RETOUCHING. Edited by Frank R. Fraprie, S.M., F.R.P.S. Boston: American Photographic Publishing Company, 1919. 8vo.; 55 pp.; illustrated.

A new edition, revised and enlarged, of a very popular little work by the editor of *American Photography*. While professional retouching is a product of natural aptitude, good teaching, and long experience, the amateur will find it possible to remedy many faults in his own negatives by a careful study of this brochure.

HERSCHEL. By Hector Macpherson, M.A. F.R.A.S. New York: The Macmillan Company, 1919. 12mo.; 78 pp.; portrait.

According to Carlyle, the history of the world is the history of its great men. Nothing is more inspiring than the story of individual accomplishment, such as is so well told in the *Pioneers of Progress* series of which this little biography is a unit. Herschel's boyhood, his experiences as amateur and professional astronomer, his solar, planetary and stellar researches, are sketched with a sure hand. There is a good plate from the portrait in the National Portrait Gallery, and the final chapter sums up his personality and influence.

ANNUAL REPORT OF THE SMITHSONIAN INSTITUTION. 1917. Washington: Government Printing Office, 1919. 8vo.; 674 pp.; illustrated.

Besides statements that enlighten us as to the numerous and valuable activities of the Institution—geological, biological, botanical, geographical, industrial, and publicational—there are the usual authoritative papers illustrative of the more important and remarkable developments in discovery. Many branches of science are represented in these papers, and most of the accounts are so phrased that the reader interested in the topics will have no difficulty in following them. The work is enriched by cuts, maps, and full-page plates of noteworthy clearness and beauty, Paradise Key and the Everglades, the structure of meteorites, the National Zoological Park—these subjects indicate the catholicity of the contents.

STABILIZING THE DOLLAR. By Irving Fisher. New York: The Macmillan Company, 1920. 8vo.; 305 pp.; illustrated.

Prof. Fisher would stabilize the general price level without fixing individual prices. The intense interest in this question is eloquently evidenced by the enthusiastic endorsement of many political economists and the no less vigorous opposition of others who would uphold the *status quo*. The plan here proposed was first outlined in 1911; the present work is an exhaustive elaboration that considers existing facts and evils, causes, and the remedy—which is to abolish gold coins and to designate a gold-bullion dollar whose weight shall vary at stated intervals to correspond with price-variations as indicated by an established "index number." In other words, to keep the price level of other things from rising or falling the price of gold is made to fall or rise. The aim is to standardize the only unit yet unstandardized—the dollar. All valid objections have had time to appear and develop, so that the need now is to weigh existing evidence for and against the plan. Certainly there is much to be said in its favor, and this is all said, and well said, in the present complete exposition.

ELECTRIC MINING MACHINERY. By Sydney F. Walker, M.I.E.E. New York and London: Isaac Pitman and Sons, 1919. 8vo.; 375 pp.; 132 illustrations.

Electricity as applied to mining work presents difficult problems not met with in town installations and factory applications. In this, his latest work, Mr. Walker essays a survey of British practice, with very creditable results. He begins with prime movers, describes the lay-out of a generating station for a mine group, passes to the dynamo and the various ways of producing and utilizing current for different purposes, and from this to the many ramifications of current transmission and application including signaling, telephony, and shot-firing. It is an able effort to put in the hands of the engineer comprehensive knowledge of modern mining problems and the way in which the electrical engineer is solving them.

MANUEL DE CULTURE MÉCANIQUE. By C. Julien. Paris (79 Boulevard Saint-Germain): Librairie Hachette, 1919. 12mo.; 128 pp.; illustrated.

France is now with characteristic enthusiasm taking up what she expressively terms "*moto-culture*." This little work by an authority addresses itself directly to the farmer, shows him the advantages of the tractor over the horse, explains the various systems of power cultivation and their use both on a small and large scale, and makes all its points in language that the farmer can understand.

MOTOR TRUCK DESIGN AND CONSTRUCTION. By C. T. Schaefer. New York: D. Van Nostrand Company, 1919. 8vo.; 318 pp.; 292 illustrations.

Every year the gasoline truck looms larger in the foreground of industry, appreciably encroaching upon the domain of the locomotive. The author's well-thought-out treatise fills a gap in automobile literature by giving the engineer expert information on current practice in design and construction; from the general lay-out of the chassis to the finer details of wheels, rims and tires, the instruction is selective of the best; the engine, with its lubricating, cooling, carburetion and control systems, is the subject of many chapters; front and four-wheel drives, the fuel supply system, and electric lighting and starting, also have their chapters; in short, every point is covered by the text and clean-cut illustrations. For the benefit of the student a general outline of underlying principles is given.

MANUAL OF METEOROLOGY. Part IV. Relation of the Wind to the Distribution of Barometric Pressure. By Sir Napier Shaw, Sc.D. F.R.S. London: Cambridge University Press. New York: G. P. Putnam's Sons, 1919. 8vo.; 166 pp.; illustrated.

The complex structure of the atmosphere must be described in the light of a guiding principle; this our distinguished author finds in the relation of the wind to the distribution of pressure. He provides practical answers to many of the urgent questions asked of the British Meteorological Office. These applications as set forth in Part IV. of the Manual are backed by the accumulated facts summarized in Part I, governed by the physical properties of air discussed in Part II, and led up to by the dynamical and thermal principles of Part III. Extremely valuable and illuminating are the original drawings from authoritative British and American sources.

SCHOOL STATISTICS AND PUBLICITY. By Carter Alexander. New York: Silver, Burdett and Company. 8vo.; 332 pp.; illustrated.

Hand in hand with industrial and political reconstruction should go educational reconstruction. That is clear. Better buildings, better teaching, better vocational advantages, are of pressing importance. The author demonstrates this in his meaty little volume, directing his remarks chiefly to that "man of the hour," the superintendent of schools. The three methods here developed for stirring the interest of the community are: good work that shall plead its own cause; personal explanations, public and private; and the superintendent's annual report and printed communications. It is aimed to make these last so interesting and convincing that they will be widely read and strongly influential.

PROBLEMS IN BOTANY. By W. L. Eikenberry. New York: Ginn and Company, 1919. 8vo.; 145 pp.; illustrated.

This is a new text with very definite characteristics of its own. It takes the actual conditions of experience as a basis, and concerns itself with the life, rather than the structure, of the plant. The instructions do not solve; they suggest; hence they conduce to original thought on the part of the pupil. The problems may be used with any textbook.

EVERY STEP IN CANNING. The Cold Pack Method. By Grace Viall Gray, Ph.B., Ed.B. Chicago: Forbes and Company, 1919. 8vo.; 253 pp.

The one period, cold-pack method of canning fruits and vegetables is rapidly being accepted on its merits. This new system is perhaps for the first time adequately explained in *Every Step in Canning*. The treatment is able, and the way is made clear for the housewife to save time, fuel, and labor, and to eliminate spoilage also.

THE AMERICAN ACCOUNTANT'S MANUAL, Vol. I. By Frank Broaker, C.P.A. New York: Frank Broaker, C.P.A. 8vo.; 210 pp.

The author holds the first C.P.A. Certificate issued in this country, and was instrumental in the legal recognition of accountancy as a learned profession. His present work carries plans and elevations of theory and practice that will appeal to both student and expert. Vol. I deals with theory, auditing, practical accounting and commercial law. These matters are so set forth as to promote a much-needed uniformity in practice. The examination questions and answers convey in utilizable form the facts and technique without which the student cannot hope for true efficiency. The treatment is concise, intelligible, and inspiring.

THE ORGAN OF THE TWENTIETH CENTURY. By George Ashdown Audsley, LL.D. New York: Dodd, Mead and Company, 1919. 8vo.; 519 pp.; 32 plates, 106 figures.

A truly opulent work is this manual on that emperor of instruments, the pipe organ. There are those to whom its ornamental architecture appeals as strongly as its voice; these will find an aiding delight in the fine plates and descriptions of notable organs. The main part of the work, however, is devoted to the general appointment and divisional apportionment of the tonal forces, together with many details that make for control, flexibility, and expression. The title of the book foreshadows the author's revolutionary ideas. He would introduce more than one expressive division; would improve the pedal clavier; and would install a distinct, properly constituted, and expressive string-toned division. His long, all-embracing experience, his evident lack of prejudice, and his able arguments, should find him an attentive audience among accomplished and open-minded musicians.

THE MODERN BANK. By Amos Kidder Fiske, A.M. New York: D. Appleton and Company, 1919. 8vo.; 345 pp.; illustrated.

This is the newly-revised edition of a work that has been well received by business men. The Federal Reserve System meant readjustments in practice and a change in the currency, and these readjustments and changes are reflected in the present edition. The work conveys a clear conception of the development and the machinery of our modern banking system, touches upon war conditions, and presents timely material on foreign banking, finances, and credit schemes in their application to peace conditions. Functions and methods take precedence of theories and principles, and the average business man will experience no difficulty in understanding the means and the ends so plainly set forth.

GERMANY'S NEW WAR AGAINST AMERICA. By Stanley Frost. New York: E. P. Dutton and Company, 1919. 8vo.; 190 pp.; folding charts.

If, as the Alien Property Custodian says, these revelations are "accurate and entirely justified by present conditions," then the sooner we absorb and profit by this knowledge of Germany's intentions the sooner may we intelligently combat them. The author's contentions, strongly sustained by argument and fact, are that by a shrewd combination of honest toil and dishonest distribution the old network of spies and masqueraders is to be used in trade conquest. The constructive elements are to be unity of control, propaganda, price slashing, discreet bribing, and compulsion by means of monopolies. It is the author's belief that Germany is in excellent condition to carry through the ambitious program successfully.

THE SCIENCE OF EATING. By Alfred W. McCann. New York: George H. Doran Company, 1919. 8vo.; 408 pp.

This enlargement of "The Famishing World" continues the effort of its author to take his case direct to the public, to stir thought toward the importance of its own physical basis, and finally to teach men to discriminate between constructive and destructive foods. The relation between denatured foods and disease is developed on a large scale; other sections of the substantial work deal with the way in which our organism handles food; with modern refining processes, "more deadly than war"; with sensational illustrations of the results of an unbalanced diet, and with the manner in which dollars dictate to science and muzzle truth; and with the preventable tragedies of milk and meet. Ideally balanced menus conclude a most comprehensive, earnest and helpful work.